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OF THE
IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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Local Production of Food Supplies.

IN the depressed conditions prevailing in the West Indies about the years 1900 to 1903, a considerable amount of attention was given by officers of the Agricultural Departments and by planters, to questions pertaining to the production of increased quantities of food within the West Indies themselves, partly with a view to finding remunerative occupation for the labouring class, and partly in the hope of profitably raising crops in substitution for imported materials. Departmental publications have frequent reference to the matter, and many efforts were

made to increase the amount of food produced on plantations, and by the peasantry.*

With the improvement in the agricultural conditions of the West Indies which took place soon after this period, notably by the revival of the sugar industry and the introduction of cotton cultivation, attention was largely directed to the production of staples for export, and the production of home-grown food again passed into a condition of comparative neglect.

The possible restriction of the importations of food supplies on account of the disturbed conditions arising from the war has caused thoughtful people once more to turn attention to this subject, and to urge the necessity for action in order to preserve the comfort and safety of the general population of these islands, including all classes. The problem now wears a different aspect, and requires to be looked at from a different point of view.

At the present moment practically all West Indian staple products are bringing high prices and there is no superabundance of labour to produce them, consequently planters are rather impelled to give all the attention they can to the production of these profitable staples, and find some difficulty in getting as much done in this direction as they could wish. In these circumstances there is a tendency to shirk the question of producing food crops, and to suggest that this matter is one which should have the consideration mainly of the peasant cultivator. The peasant, on the other hand, wonders why he should be urged to do what the planter avoids. Progress is, therefore, far from rapid, and there remains an undue dependence upon imported foods

*See *West Indian Bulletin*, Vols. I, p. 270; II, p. 293; III, pp. 9 and 206.

The general outlook on this subject is well indicated in the article in the *Agricultural News*, Vol. I, p. 225

which may entail unpleasant consequences in the near future. It may reasonably be urged that the question is one which mainly concerns the large cultivators and estate owners; that it is a general economic one bearing on the welfare of the community, and on that of the labourers on whom the successful working of the estates depends. It would appear that it would be prudent for estate proprietors to give careful thought to the matter, and to ensure the presence of a good food supply, each in proportion to his stake in the country. Such a course may necessitate the surrendering of a certain amount of apparent profit from staple crops; but the problems confronting these islands now are not those of merely making estates pay, as was the case in the early period referred to at the beginning of this article, but concern vital matters of food to eat, and the maintaining of workers of all classes in a condition in which they may adequately carry on the production of money-making staple crops.

The obvious course is the production of reasonable quantities of quickly grown foods, such as sweet potatoes, Indian corn, Guinea corn, beans and peas, and other quick-growing crops. Other crops which take longer to produce should also have consideration, each in the circumstances where it may be grown to advantage: different islands present very different conditions when regarded from the point of view of the suitability of producing certain crops. In this connexion attention will be centred upon such crops as yams, eddoes, bananas, plantains.

The raising of pigs, as a readily available means of increasing the supply of food in these islands, not to speak of the importance of the matter from the point of view of exports, has not received the attention which the subject appears to warrant. There is a limited industry based upon the raising of pigs confined in pens, but it would seem that there is wide scope for the raising of pigs upon pastures, or penned upon cultivated ground, and that there are large areas in many islands where work of this kind could be carried on to advantage.

Amongst the obstacles that stand in the way of adequate production of West Indian food supplies are the difficulties incidental to storage and to distribution. Certain food crops, such as sweet potatoes, bananas, breadfruit and the like, will not keep long and have, in existing circumstances, to be disposed of quickly; at the same time the facilities for distribution are defective, consequently waste may ensue and the cultivators' efforts be discouraged. Again, locally grown grains are difficult to store on account of their liability to become mouldy and to be attacked by insects—real

The question of storing grain has been actively dealt with by two West Indian Governments, Antigua and St. Vincent, which have erected Hess Corn Driers and arranged for their use in various ways, either by placing the machines at the disposal of the growers of grain, whereby their crops may be dried for storage at moderate rates, or by buying, drying and storing grain on co-operative lines*. Progress in this connexion is necessarily slow, but there is reason for thinking that the establishment of these driers will prove of considerable service and lead to many useful developments. In the case of many vegetables the question of keeping may be overcome by converting them into meal. Much attention was given to this question some years ago, and some progress was made in ascertaining what may be done, particularly in the case of sweet potatoes. Useful work has also been done in connexion with the preparation of banana meal. The preparation of corn meal is well understood, and the limitations of home-made, whole corn meal realized. Guinea corn meal is also a recognized article of food, but practically in Barbados only.

At this juncture the problem of meal-making deserves to have special consideration. It is recognized that the first essential is to have the means of drying the material. There are many forms of drying machines on the market, several of which may prove suitable. Experiments have already been made with some degree of success in the drying of material for the production of meal by means of the Hess Corn Drier. Work already done in this direction by Mr. W. N. Sands, Agricultural Superintendent at St. Vincent, is quite encouraging and will have further attention in these pages.

Some difficulty is experienced in inducing people to eat new forms of food: the suggestion to use sweet potato meal or banana meal has not found very ready response, so that, except under pressure of necessity, it would appear that a campaign of educating and of advertising is necessary to ensure the adequate introduction of new meals into common use. One form of use which is easy and economical, and which forcibly appeals at the present moment, is to mix certain meals with wheat flour in the making of bread. This idea is not a new one: indeed it is extremely old, and one of which the legislation of various countries has taken cognizance. Experiments which have recently been made at Antigua are referred to on another page of this issue (p. 4). From these it is evident that there is considerable scope for the local use of various meals,

* *Agricultural News* (Antigua) Vol. XIV, pp. 53, 55, etc.

such as those prepared from corn, Guinea corn, sweet potatoes, bananas, breadfruit and others, in the making of bread. By such a process there would result a decreased demand for imported flour and an increased consumption of locally grown food, with the concomitant stimulation of local enterprise and ingenuity. This aspect of the case deserves the consideration of the local Governments who require large quantities of bread for the use of various public institutions.

It may be noted that of recent years there have been considerable additions to the supplies of foods produced in the West Indies and British Guiana. The most notable is the development of the important rice industry of British Guiana, whereby that Colony is now supplied with rice of its own production, and an export trade of considerable magnitude is being built up. In 1915 the export of rice alone amounted to 9,230 tons valued at some £134,967: in addition to this a very large quantity is consumed within the colony. The cultivation of rice is also becoming important in Trinidad. There are limitations to the extension of this industry in the West Indian islands, for rice appears to be intimately associated with East Indians and low-lying country—conditions that are not widely met with, so little expansion of this industry can be looked for north of Trinidad.

It may not be generally recognized that the cotton industry has contributed in no unimportant degree to the food supply of these islands. There is now a large output of cotton-seed oil which finds a ready local sale. The importance of this aspect of the case may be recognized when it is stated that the output of cotton seed in the West Indies last year must have exceeded 1,880 tons, a quantity which would be capable of producing some 75,300 gallons of oil. Indirectly, too, cotton is capable of contributing largely to the food supply through the cotton-seed meal which results from the expression of the oil. This meal is capable of forming an important addition to the food of cattle and thus of increasing the output of milk and beef. It may be regretted that this application is not at present made as full use of as is possible and desirable.

Another addition to the food supply arises from the increased cultivation of coco-nuts. Coco-nut oil is a valuable article of food, while the meal remaining after the expression of the oil is a valuable food for cattle; it has the advantage, not possessed by cotton-seed meal, that it may be used as food for pigs, and should tend to make pig-raising an easy and remunerative business, with the consequent increase of locally produced food.

It must be admitted that there are extensive opportunities for the production and use of locally grown food supplies, though skill, care, and patience will be necessary in realizing them. In order to stimulate progress it is necessary to create sound public opinion on this question—an object which may be obtained by ventilating it in meetings of representative bodies such as the Agricultural and Commercial Societies, and through the activities of officers of the several Departments of Agriculture. It is extremely desirable that vigorous efforts should be made to ensure more lively activity in this connexion.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland, of Liverpool, write as follows, under date December 11, 1916, with reference to the sales of West Indian Sea Island cotton:—

We have nothing to add to our last report with regard to West Indian Sea Island cotton, but expect when the new crop comes in quantity on the market it will command good prices.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ending December 2, 1916, is as follows:—

ISLANDS. There has been no change in the market this week. The receipts were 225 bales, sales 78 bales. All of the limited offerings of Fine were taken at 52c., and of Extra Fine at 55c. to 56c., but at the close of the week with advanced quotations in Savannah, Factors have advanced their prices $\frac{1}{2}$ c. to 1c. Consequently quotations are advanced for—

Fine to	52 $\frac{1}{2}$ c. to 53c. = 54c. to 54 $\frac{1}{2}$ c. landed.
Extra Fine to	56c. = 57 $\frac{1}{2}$ c. „

There have been no sales as yet of planters' crop lots of Extra Fine.

GEORGIAS AND FLORIDAS. The buying on account of the Northern Mills continues active, taking all offerings at hardening and advancing prices, so that the market closed very firm at 1c. higher. The shipments to the mills you will note are very large, notwithstanding the embargo on freight by the New Haven Railroad, the total this week from Savannah being 3,312 bales, and from Jacksonville 2,236 bales, aggregating 5,548 bales. At this rate the crop is disappearing very rapidly, and the unsold portion of the crop is getting into strong hands, the planters and small holders having disposed of their stocks very largely.

We quote, viz:—

GEORGIAS AND FLORIDAS.

Extra Choice and Fancy	52c. to 53c. = 53 $\frac{1}{2}$ c. to 54 $\frac{1}{2}$ c. landed.
Choice and Extra Choice	52c. = 53 $\frac{1}{2}$ c. „

The exports from Savannah for the week were, to Liverpool 100 bales, Southern Mills 109 bales, Northern Mills 3,103 bales, and from Jacksonville to Northern Mills 2,236 bales.

STANDARD BREAD.

The high price of bread in the West Indies at the present time, and the possibility of a shortage of flour in the future, make the following article appearing in *Nature* for November 23, both interesting and important to West Indian readers, as well as to the people of Great Britain:—

The decision of the Government, which appears likely to result in the general consumption of 'standard bread', will no doubt be received with varied feelings by various sections of the community. In view of the certainty that such differences of opinion are likely to arise, the following brief sketch of the facts of the case so far as they are known may be of general interest.

Under normal conditions at the present time, the average practice of roller milling results in the recovery from cleaned wheat of rather more than 70 per cent. of its weight of flour, the remaining 28 or 29 per cent. of the wheat, consisting of various grades of 'offals', being sold for feeding stock.

The changes announced last week would make it compulsory to recover 80 per cent. of flour from wheat, which would increase the amount of flour by about $8\frac{1}{2}$ per cent., and decrease the amount of offals for stock-feeding by a like proportion, the percentage in both cases being calculated on the amount of cleaned wheat available for milling.

On the basis of the amount of flour produced in the United Kingdom for home consumption in the years immediately before the war, the change announced would increase the amount of flour available for bread-making by very nearly 600,000 tons, which would provide an extra 2-lb. loaf for every inhabitant of the United Kingdom every three weeks, or seventeen extra 2-lb. loaves per head of the population per year. This is by no means a negligible increase in the bread supply, and it is doubtless considerations of this kind that have induced the Government to take action.

If, however, we examine the result rather more closely, we find that the increase in the nation's food supply may not be so great as the above figures indicate. In spite of repeated statements to the contrary, bread made from 80 per cent. flour is not so nutritious, weight for weight, as bread made from 70 per cent. flour—at any rate, for the supply of protein and energy for the general population. Although 80 per cent. bread contains, on the average, rather more protein than 70 per cent. bread, the digestibility of the protein in the former is rather lower, so that the actual weight of protein digested by the average individual from 1 lb. of 80 per cent. bread is rather less than the amount digested from 1 lb. of 70 per cent. bread. Again, the energy value of 80 per cent. bread is rather lower than that of 70 per cent. bread. Still one more correction must be made in order to arrive at the actual increase in the national food supply which will result from the general adoption of a milling standard of 80 per cent. It is pointed out above that the recovery of 80 per cent. of flour from cleaned wheat entails a decrease in the supply of the finer wheat offals for stock-feeding to the extent of about 600,000 tons. These finer offals are largely used for feeding pigs. Their transference to human consumption would therefore decrease the production of pork and bacon, and this must be allowed for in estimating the total effect of the proposed alterations in milling. After applying all these corrections, it appears that the general adoption of an 80 per cent. standard would undoubtedly give a substantial increase in the amount of digestible food for the supply of protein and energy for the population of the United Kingdom.

The possibility that the food value of bread would be substantially increased by the adoption of the 80 per cent. standard, because the content of the mysterious constituents

known as vitamins would be increased by the inclusion of a greater proportion of the germ and of the outer layers of the grain, is perhaps scarcely worth discussing in this connexion. Such constituents are supplied by other items comprised in an ordinary mixed diet, so that the vitamin content of bread can have little practical significance except in the very few cases where bread forms the whole, or very nearly the whole, of the diet.

The price of wheat offals for feeding stock is now so high that the adoption of the 80 per cent. standard cannot be expected to make any considerable reduction in the price of bread. Even the compulsory admixture of a considerable proportion of other cereals such as maize, oats, or barley, with wheat for bread-making would not greatly cheapen the loaf, because these cereals are not very much cheaper than wheat. The important point in raising the milling standard and in including other cereals among the bread-stuffs is that it would widen the sources from which the national food supply is derived—a most desirable end under existing conditions. To summarize, the result of a compulsory 80 per cent. standard would be neither better bread nor cheaper bread, but more bread.

BREAD DILUTED WITH SWEET POTATO MEAL AND CORN MEAL.

Dr. H. A. Tempany, Superintendent of Agriculture for the Leeward Islands, has forwarded to this Office a report on experiments connected with the baking of bread from flour diluted with sweet potato meal and with corn meal, carried out with the kind co-operation of Mr. R. S. Mendes, on the recommendation of the Central Board for Co-operative Organizations.

For the purpose of these experiments, a quantity of sweet potato meal was prepared in the Government laboratory, Antigua. In making the meal the potatoes were not peeled, as from a commercial stand-point this operation adds very appreciably to the cost of production. Sample loaves of bread were baked, using wheat flour as a basis, diluted with sweet potato meal prepared as above stated, and with corn meal, in the following proportions:—

- Series A: Wheat flour 3 parts,
Sweet potato meal, or corn meal, 1 part.
- Series B: Wheat flour 2 parts,
Sweet potato meal, or corn meal, 1 part.

In both series of experiments very satisfactory bread is said to have been produced. The bread diluted with sweet potato meal was brown in colour, and resembled both in appearance and flavour whole meal wheaten bread; that diluted with corn meal was of a very pale-yellow colour, and of a distinctly palatable flavour.

It will be observed that attention is directed to the fact, that in the preparation of the potato meal in these experiments, the potatoes were not peeled. The peeling of the potatoes in the preparation of potato meal may rightly be regarded as an unnecessary addition to the cost of production, for the simple reason that the skin of the potato is very thin, and the amount of such material introduced into the meal would be so inconsiderable as to have no harmful effect on the bread produced, either from the point of colour or flavour. It seems that all that is required in the preparation so far, is to have the potatoes washed thoroughly clean.

The success of these experiments appears to have been complete. Another point, however, occurs to us in connexion with these experiments: it is whether bread produced by an admixture of meals as shown above, could not be rendered more nutritive with the addition of bean flour, which is

known to possess a higher percentage of nitrogenous matter than potato flour.

In this connexion reference might be made to results of experiments which were carried out in the West Indies in the preparation of sweet potato meal, and published in the *West Indian Bulletin*, Vol. II, pp. 293-8. Analyses of samples of dried potato meal showed that the meal is deficient in flesh-forming nutrients. The point is whether the experiments now in progress in the Leeward Islands might not be extended and directed towards ascertaining if the known deficiency in proteid matter in the sweet potato meal cannot be counterbalanced by supplementing it with bean flour or pea flour, which is known to be rich in nitrogenous constituents. Might not trials be made of an admixture, say, of wheat flour 2 parts, sweet potato meal 2 parts, bean meal 1 part or less; or, wheat flour 3 parts, corn meal 2 parts, bean meal 1 part or less.

The above experiments demonstrate that a satisfactory bread can be made with wheat flour diluted in the manner stated. It is possible that further experimentation on the lines now suggested, that is to say, with the addition of bean flour may show that bread of a more nutritive value can be made. It is worthy of consideration whether it might not be well to institute trials on a large scale with a view to popularizing bread made in this way, thereby reducing the large importations of wheat flour, and at the same time providing a nutritive diet for the people.

EXPERIMENTS WITH LIMA BEANS IN ST. VINCENT.

Much attention has been paid to Lima beans during the past year, and trials have been made of the following varieties: (1) St. Vincent Native Pole, (2) Barbados Native Pole, (3) Barbuda Pole, (4) Henderson's Ideal Pole Lima, (5) Henderson's Bush Lima, (6) Drier's Improved Pole Lima, (7) Early Giant Bush Lima, (8) Fordhook Pole Lima, (9) Fordhook Bush Lima, (10) Large White Pole Lima, (11) King of the Garden. Of these Nos. 4 to 11 were from the United States.

A series of plots of the American varieties was laid out early in June. Most of the seedlings failed to reach the surface; the others grew very poorly and the leaves remained yellow and sickly. The cause of this was a damping-off fungus similar to *Pythium de Baryanum*. The plots were therefore abandoned. It was considered that the chief cause of failure was the abnormally wet weather at this time.

Another series of plots was therefore laid out at the end of November. A study of the behaviour of these plots has led to the following conclusions:—

The varieties of Lima beans indigenous to the West Indies germinated better, and were not so subject to the attack of the damping-off fungus as the imported varieties. Indigenous varieties also grew more rapidly. The St. Vincent Native grew faster than the Barbados and Barbuda varieties. All these three flowered profusely but failed to produce ripe pods unless provided with supports on which to climb, since all the pods dropped as soon as they were a few millimetres long.

The shedding of pods was very marked in the American types, and the only variety from that country which showed any promise was Henderson's Bush Lima. The phenomenon of pod-dropping in Lima beans seems closely allied to that of boll-shedding in cotton, and is probably due to a similar set of causes, namely, sudden changes in environmental conditions, and particularly of soil and air moisture. In cotton there are notable differences in constitutional liability to boll-shedding. Similar differences also exist in Lima beans. Selection in the variety Henderson's Bush Lima has now

been in progress for four generations, and we now have a fairly satisfactory strain which yields well under St. Vincent conditions.

In regard to maturity, the American varieties are earlier than West Indian.

Thus, Henderson's Bush Lima matures in from sixty-eight to seventy-seven days, while St. Vincent Native takes from 110 to 120 days.

A report has been received from Bequia that a piece of ground of approximately $\frac{1}{4}$ -acre in area, planted in Barbuda beans, which were allowed to run on cassava, yielded over 300 lb. of dry beans. The yield of cassava was said to be low, however. It will thus be seen that under the drier conditions of the Grenadines, satisfactory returns can be obtained.

The opinion may be expressed that a careful study of the behaviour of the different varieties of Lima beans from a physiological stand-point, combined with selection, will result in knowledge which will enable this crop to be grown quite successfully in St. Vincent.

Twelve varieties of Brazilian beans, received from the Head Office, failed to germinate owing to continued unfavourable weather. (Report on the Agricultural Department, St. Vincent, 1915-16.)

WEST INDIAN SOUR GRASS.

The Director of the Royal Botanic Gardens, Kew, has kindly communicated to the Commissioner of Agriculture a memorandum by Dr. O. Stapf on the question of the origin of West Indian sour grass. It is to be read as a continuation of Dr. Stapf's previous report on this subject, of which a summary was published on page 179 of Volume XV of this Journal. The memorandum states:—

Mr. Maiden has been good enough to send a report by Mr. Cheel, one of his assistants, on the Australian *Andropogoneae* which have been connected by various authors with *Andropogon pertusus*, the species to which the West Indian sour grass has generally been referred so far.

Mr. Cheel has also come to the conclusion that the true *Andropogon pertusus* of India does not occur in Australia, and he considers the *A. pertusus* of the Flora Australiensis and Australian authors to be an endemic species identical with Hackel's *A. intermedius*, var. *decipiens*. This he proposes to call *A. decipiens*, and he limits its area to Northern New South Wales and Queensland. I have not referred to Hackel's *A. intermedius*, var. *decipiens* in my report on the West Indian Sour Grasses, because we had none of the specimens quoted by Hackel as type, whilst at the same time the description of it did not suggest any connexion with West Indian grasses under consideration. Mr. Maiden has now sent specimens of what he and Mr. Cheel take to be Hackel's 'var. *decipiens*'. I have no reason to doubt their identification. This *A. decipiens* is quite distinct from any of the sour grasses I have seen. As to the 'Andropogon collected by Max Koch on Mt. Lyndhurst, S. Australia, and distributed under the name *Andropogon punctatus*, Roxb., with the annotation 'good fodder', Messrs. Maiden and Cheel have no further observation to make, but they, too, refer it to *A. intermedius* (I called it *A. intermedius*, var. *pabularis* in my report). Mt. Lyndhurst is too far inland to suggest any connexion with the introduction of a fodder grass into the West Indies at an early time. Thus it seems to be evident that Australia is quite out of question in so far as the origin of Barbados Sour Grass (*Amphilophis intermedius*, var. *acidula* of my report) is concerned.

JAMAICA AND THE FOOD SUPPLY QUESTION.

In recent issues of the *Agricultural News*, attention has been repeatedly called to the need of producing more foodstuffs in the West Indies. Some practical advice on the subject has been published in the *Journal of the Jamaica Agricultural Society* for October 1916, and is reproduced below:—

In a time like this, every available corner of the holding should be planted with some crop yielding food. Corn, peas, beans, and sweet potatoes, are the quickest and most useful foods. Foodstuffs are becoming scarce all the world over. Millions of men that were food producers are now taken from the production of land and sea products to engage in warfare. The salt codfish we are all so familiar with, is a crop of the sea gathered by Newfoundland fishermen, large numbers of whom are now in the British Navy, and there is a shortage of that food so useful to us here. The most vital crop to the world, however, is wheat from which the flour that makes our bread is made: most of our supply comes from the United States, and there they fear a shortage for themselves, so that there is talk of restricting exports. At any rate the price of flour has gone up to a very high figure and may go higher. On the top of dear bread, we have lost our supply of bananas for a year, a most important food to us. When the war began we used to say that if the enemy's ships did interfere with our imports and exports, we had always our great crop of bananas to fall back upon for our food supply.

Immediately the war broke out, we communicated with all our Branch Societies showing the likelihood of foodstuffs becoming dear, and the advisability of planting food crops as much as possible. There was a good response to that advice and almost every crop has been plentiful since, in spite of the increased home consumption through the dearth of imported foods.

Jamaica has been one of the best off places since the war broke out, and would have continued to be but for two unfortunate hurricanes in two consecutive years. It now behoves every one who can do so, to plant food crops; it was advisable at the time the war broke out, it is a necessity now.

CORN. Plant corn in succession as long as there is any chance of it growing well. We have sent out for planting 70 bushels of first class seed corn—all that could be secured—and a quantity of ordinary good corn for seed. After planting the corn do not let weeds get ahead but cultivate carefully and get as large crops as possible.

GUINEA CORN. We are very much disappointed that there has not been a better demand for Guinea corn for planting, but we suppose because of the good seasons in the ordinarily dry districts, planters are growing country corn. Still suppose we have drought after November, the Guinea corn would thrive through it.

PEAS AND BEANS. These are quick and very sure crops to grow. They are useful to plant out in odd places. Everyone planting should plant kidney beans, cowpeas or black-eye peas through bananas. The planting of kidney beans can go on in most districts right through each month to April next. Cowpeas and black-eye peas do not grow well in the hills during the winter. They are summer crops there. But in the lowlands they also can be planted from October to April. In the hills, begin planting cowpeas and black-eye peas in February.

SWEET POTATOES. Keep on planting in succession so as to have some fit potatoes to dig every week. When disease

or weevils have attacked, dig up, gather and destroy all the bits of potatoes lying about, and plant another crop, not a root crop.

GARDEN. Everyone should try to grow vegetables like cabbages, turnips, carrots, beets, spinach, parsley, tomatoes, etc. They are good for sale in towns, add variety to the food in the house, and are good for the health. Make the seed beds fine, but firm down when sowing, so that the little seeds come in close contact with the fine soil. Do not plant deep. The smaller the seed the lighter the covering of earth. Sow in drills rather than broadcast. If the soil is stiff and has not been turned over early enough to let sun and rain scatter it so that in spite of cultivation it remains lumpy while you are in haste to plant (a condition we have often found ourselves in), make the little drills deeper and wider, scrape up the fine earth from the footpaths or trenches or cow pen, and crumble it in the drills. Press it down and sow the seeds. Cover with fine soil, press down again, and if heavy rains are likely to be hurtful put a thin covering of fine trash over the drills. This gives the little seeds a good start in fine soil. By the time they are spreading their little roots, the soil of the beds has become settled and finer. When the young plants peep up, lift off the mulch, and as the seeds grow, scrape a little earth into them to support them.

In gardening on a small scale, it is useful to use seed boxes. Get from the shop some condensed milk boxes (which are better for the purpose than soap boxes), punch a few holes in the bottom, put a layer of small stones in the bottom and fill with good earth pressed in firmly. These boxes have the advantage of allowing early planting safely, as they can be shifted under cover if heavy October rains come on, which might wash out the tender sprouting seedlings from the seed beds in the open. Such seeds as tomato, cabbage and ochro are usually the better for transplanting; although turnip, carrot and beet are often transplanted here, they are better sown thinly where they are to grow.

FOWLS. Eggs will likely be dearer too, because many having no spare food for their fowls have cut down their number. If flour is dear, corn meal will be dear too. The thing to do is to plant plenty of corn.

About the only foods that have not gone up in price are local meatstuffs and milk. Milk has always been dear in Kingston—6d. a quart; in the country it was always cheap where sold at 3d. Beef still remains at 6d. per lb. and goat mutton at 6d. per lb., but pork is 7d. per lb. in Kingston. In small country towns beef and goat mutton are 4½d., but pork is 6d., even 7d. per lb. Pig feeding is scarce because we have no bananas, so that pigs will be scarce too until this food becomes plentiful.

Our domestic stock is of greater value now to us than ever, and should be attended to with redoubled watchfulness and care.

DEPARTMENT NEWS.

Dr. J. C. Hutson, B.A., Ph. D., Acting Entomologist on the staff of the Imperial Department of Agriculture, who left Barbados on December 29, 1916, on an official visit to Grenada, returned to Barbados on January 11.

Mr. W. R. Dunlop, the Scientific Assistant, also returned from a visit to Trinidad on January 11.

THE NEW YORK BOTANICAL GARDEN.

Of much interest to the West Indies should the *Bulletin of the New York Botanical Garden* (Vol. 9, No. 34) prove, not only because it comprises a descriptive guide to the grounds, buildings, and collections of the New York Botanical Garden, but inasmuch as the collections in the conservatories and flower gardens, which are ranged in different compartments designated and numbered as 'houses', include many species of West Indian origin, and introduced plants now of common occurrence in the West Indies.

For example, amongst the collection of palms of numerous species from all parts of tropical and warm regions, both of the Old and the New World: of West Indian palms, the collection contains the royal palm of Cuba and Florida, an elegant plant of the corozo palm (*Acrocomia media*) of Porto Rico and the Windward Islands; the coco-nut palm, planted in all tropical countries for its fruit, and for the numerous uses to which its fibre, wood and leaves are applied. There is also in this collection a group of bamboos, which belong to the grass family, the most noteworthy of them being the Chinese bamboo (*Bambusa vulgaris*). Among the specimens illustrating monocotyledonous plants of tropical regions are included the amaryllis family, which is represented by a number of species of the spider lily (*Hymenocallis*), bearing large white flowers, the commonest being *Hymenocallis expansa* from the sandy coasts of the West Indies. In this collection is also seen specimens of maguey of the West Indies (a spiny-leaved relative of the century plant, native of the West Indies, and used there for hedges). In House No. 4, where are brought together many kinds of large tropical plants, the collection includes species of fig (*Ficus elastica*) and cacao (*Theobroma Cacao*) native of tropical America. Specimens illustrating the chocolate industry are to be found in the economic museum; here too is the papaya, or papaw, also of tropical America. A specimen of the breadfruit tree (*Artocarpus incisa*) may also be seen here. Agaves comprise the plant collection in House No. 6, among which are many species grown in the West Indies; and it is remarked that the collection of West Indian Agaves is especially rich in species. The cactus family is represented in another department, where may be seen the genus *Cereus*, and its many related genera. An interesting economic plant in House 8 is *Nopalea coccinellifera*, upon which the cochineal insect breeds; it is from these insects that the dye cochineal was obtained. House No. 10 contains specimens of the aroids, represented by a large number of different species. Species of *Anthurium*, known as tail-flowers, it may be remarked, are abundant in the West Indies and Tropical America, as is the genus *Philodendron*. In House No. 11 are brought together many plants belonging to the banana, ginger, and canna families. There is also here, a collection of pine-apple plants. In the house allotted to the orchid family is observed an interesting palm, the double coco-nut (*Lodoicea maldivica*), a native of the Seychelles Islands, also known as the coco-de-mer, and coco-des-Maldives, and one of the rarest palms in cultivation. Plants of this palm have been established in Botanic Stations in the West Indies. In a section of this department is also installed the collection of Sago palms or cycads.

The museum of economic botany forms not the least interesting feature of the Garden. Herein are brought together collections of fibres, including cotton, rubber, and allied products; dye stuffs, including fustic, logwood, and Brazil wood; tobaccos and masticatories, including cured leaves of the tobacco plants (species of *Nicotiana*) from different parts of America; beverages, represented by both

the non-alcoholic and the alcoholic, including chocolate; fixed oils and volatile oils, including castor oil, and cotton oil; starches, including arrowroot, sweet potato flour, banana flour, etc.; and sugars.

PALM KERNEL CAKE AS A FEEDING STUFF.

The *Journal of the Board of Agriculture* of England and Wales publishes the following results as to the success obtained with this new feeding stuff in Great Britain:—

PALATABILITY.—(a) The initial difficulty of securing a satisfactory consumption of palm kernel cake by cattle or sheep is due less to unattractive flavour or aroma than to physical difficulties of mastication and swallowing, which arise probably from the characteristic 'grittiness' of the cake. With reasonable care in introducing the cake into rations this difficulty soon ceases to be of practical significance, although the rate of consumption is much slower than with other commonly used cakes.

(b) The difficulty cannot be avoided by moistening the cake or by admixture of relatively small quantities of molasses, 'spices' or other appetising ingredients. It becomes insignificant, however, if the cake be mixed with other foods in amounts such that the palm kernel cake does not form more than one-third to one-half of the total mixture.

KEEPING PROPERTIES.—(a) Palm kernel cake has been kept alongside other cakes in the farm store for six months and showed neither in outward characteristics nor in composition any sign of deterioration that was not equally marked in the other cakes, with the exception of linseed cake and possibly soya cake.

(b) In laboratory tests in which the conditions of storage were made as unfavourable as possible, the palm kernel cake did not go mouldy, but, in common with the other cakes tested, showed considerable decomposition of the oil. A rise in the acidity of the oil during storage is common to all oil-cakes.

DIGESTIBILITY.—(a) The direct determination of the digestibility of palm kernel cake and extracted meal in an experiment with two sheep showed these foods to be very satisfactory in this respect. They must rank amongst the most digestible foods at the farmer's disposal.

(b) Estimates based upon the results of the experiments indicate that the palm kernel cake used was worth 35 per cent. more, and the extracted palm kernel meal 23 per cent. more than the Egyptian undecorticated cotton-seed cake used.

INFLUENCE UPON MILK SECRETION.—(a) In a small-scale experiment with five cows indications were obtained of a specific favourable influence of palm kernel cake upon the production of milk-fat, leading to a slight increase in the fat-content of the milk.

(b) This increase was more marked in the evening milk than in the morning milk.

(c) The magnitude of the increase varied greatly with the individual cows, and in some cases was within the range of probable error.

INFLUENCE UPON CHARACTER OF MILK-FAT.—The examination of samples of fat prepared twice weekly from two of the cows used for the experiment referred to demonstrated that the feeding of palm kernel cake exercised an effect upon the composition of the milk-fat such as might be obtained by passage of some ingredients of the palm kernel oil into the milk-fat.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Francis Watts, C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue deals with the local production of food supplies, and points out that the problems now confronting the West Indian islands are not those of merely making estates pay, but concern vital matters of food to eat.

An interesting article dealing with experiments carried out in Antigua in connexion with the baking of bread from flour diluted with sweet potato meal and with corn meal, appears on page 4.

Insect Notes, on page 10, deal with the spiny citrus white fly—a potential pest of citrus trees.

Plant Diseases comprise a summary of notes on fungi and plant diseases published during 1916.

St. Lucia Agricultural and Commercial Society.

The *Voice of St. Lucia* for December 9 contains a report on the meeting of this Society held on Tuesday, November 28. The proceedings were opened by His Honour the Administrator. The first matter discussed were the recommendations of the Paris Economic Conference, and a Resolution was passed adopting the views of the Conference. The next matter considered was that the Society should become a member of the Associated Chamber of Commerce for the West Indies, the first meeting of which has been fixed for February 1917, in Trinidad. A Prize-Holdings Scheme for cacao and limes on the lines of a former scheme was suggested. The members favoured the scheme, and the details were referred to a Committee. A member then brought up the question of the scarcity of ground provisions. The view was expressed that the scarcity was due to some extent to want of labour which was called off to work on the road scheme. Another member felt it was due in a great degree to the want of better facilities for transport. Lastly, it was moved that the Secretary be instructed to write to the Government, requesting that the agents of the Quebec Steamship Company be asked to forward a request that their ships should, when sufficient inducement offered, say, the shipment of 300 barrels of limes, come alongside the wharf to take in the cargo instead of remaining at the mouth of the harbour, which they now do. The Secretary stated that he was asked to bring forward the question of including among the provisions of the Minor Products Ordinance, limes, bay leaves, etc. This suggestion was agreed to.

Feeding Value of Vegetable-Ivory Meal.

The *Journal of Agricultural Research* for November 13, 1916, publishes details and results of experiments conducted with a view to determining the chemical composition, digestibility, and feeding value of vegetable-ivory meal.

Vegetable ivory, or the corozo nut, as it is commonly known in commerce, is the seed or nut of the palm-like plant *Phytelephas macrocarpa*. These nuts are used principally for the manufacture of buttons, large quantities of them being imported annually by Great Britain and Germany, the United States using about 10,000 tons annually. In the process of manufacture a considerable portion of the nut is wasted in the form of sawdust, chips, and turnings. In foreign countries this waste has been mixed with other ingredients to be used as a cattle food. In the last few years considerable attention has been attracted in the United States to the enormous amount of waste material produced by ivory button factories, and many attempts have been made to discover a practical use for the material, aside from fuel. The experiments referred to above were undertaken with that object in view, attention being directed chiefly to the feeding value of vegetable-ivory meal. Following are some of the important conclusions arrived at:—

'Analyses show vegetable ivory to be carbohydrate in nature, containing about 5 per cent. of protein, and 75 per cent. of nitrogen-free extract. Fat and mineral

matter are negligible, while crude fibre averages 7 per cent.

The energy equivalent of the material ranks well with other carbohydrate foods, and it possesses a fuel value equal to one-half that of soft coal.

Sheep ate vegetable-ivory meal readily when it was mixed with other grains, and digested it very thoroughly: 34 per cent. of the dry matter and 92 per cent. of the nitrogen-free extract were digested.

All the carbohydrates appeared to have been hydrolyzed and absorbed in the digestive tract.

Cows ate the material when mixed with other feed, without evidence of digestive disturbances. They refused to eat it fed by itself.

When fed as an addition to a basal ration, the increase in milk was sufficient to indicate its positive value as a productive feed.

Though the methods of feeding necessarily followed were not such that exact relative values could be shown, it seems certain that vegetable-ivory meal does not fully equal corn meal for milk production.

It is satisfactory to note that these experiments point to the possibility of a large quantity of waste material being brought into economic use as a supplementary feeding stuff for live stock.

Home Practice in Agriculture.

The following summary of a paper which appears in *Bulletin No. 385*, United States Department of Agriculture, on the subject of school credit for home practice in agriculture, should be profitable to those engaged in the conduct of school gardens and agricultural instruction in the West Indies:—

(1) The home farm may be the logical laboratory for practical work connected with rural school agriculture. Home work carried on for this purpose may properly be given school credit just as home study of arithmetic gains credit.

(2) The relative importance of a project from the school point of view depends upon its relation to school study; the amount of education involved; the improvement of the pupil in skill, method, or knowledge; the results or relative success measured partly by crops or profits; and the reports, essays, exhibits and other evidence given at school.

(3) The weight given should recognize, besides the educational factors, the period covered by the project; the hours of labour involved and the relative difficulty; the evidence of good management; the emergencies met and pests combated; and the success of adults in the same line of work during the same season.

(4) The rank should depend on evidences of honest endeavour and thoughtful application of instructions.

(5) Both weight and rank should be based upon the usual method of ranking and crediting school subjects. Manual practice should not receive too much or too little relative recognition.

(6) Until local records are compiled and analyzed from boys' and girls' projects, it will be best to use the most available records of man labour, modified as to

relative difficulty, number of new operations involved, and other factors. These estimates may be gradually modified as experience is gained. The educational feature should always be kept in mind.

New Apparatus for Testing the Weight of Grain.

The United States Department of Agriculture has issued as *Bulletin No. 472*, an illustrated account of an improved apparatus for determining the test weight of grain with a standard method of making the test. When grain is sold by grade, as most of that which gets into commerce is at one time or another before it is finally consumed, the price is almost invariably found to be parallel with the grade, that is, the highest grades command the highest prices, while the lowest grades command the lowest prices. In these grades a minimum test weight per bushel is usually specified. Such conditions indicate the importance of the weight per bushel test for grain. There are various methods of making the test weight per bushel of grain but these are not sufficiently standardized to prove really satisfactory. The special device described in this *Bulletin* is an apparatus which consists in the main of two parts: the stand, with hopper and overflow pan; and the kettle, with a special beam.

Reference should be made for details to the illustrations in the *Bulletin*, one of which gives the front view of the apparatus showing the hopper to the left and the filled test kettle balancing the special beam. Another illustrates the side view, showing the beam swung to the right, and the hopper and test kettle in place ready for filling the kettle.

Pig-Raising.

In the last issue we published notes to show that very little is being done in Cuba to increase local pig production to take the place of the £2,000,000 worth of pork products imported annually. Yet in Cuba, as in many of the British West Indian islands, there is an abundance of suitable food material available, and plenty of room for the maintenance of these animals in herds. The fact was recorded that some enterprising capitalists in the United States however, have realized the possibilities before pork production in Cuba, and have a project on foot for starting a hog ranch and packing house on 20,000 acres of land about sixty miles from Habana.

Referring to an editorial in a recent number of the *Agricultural News* on the shortage of pigs, *Tropical Life* for October again recommends the keeping of pigs on coco-nut estates, one advantage being the manure produced by the animals which would be partly fed on concentrated foodstuffs like coco-nut cake. The pigs would need be penned, and some kind of quarantine station would be necessary for isolating infected animals in the event of disease breaking out. Efforts should be made to secure the best bred animals possible, for, as *Tropical Life* points out, all field produce realizes a much higher price per ton when fed to the well-bred stock than when consumed by the second and third-rate animals.

INSECT NOTES.

THE SPINY CITRUS WHITE FLY.—A
POTENTIAL PEST OF CITRUS TREES.

A paper was recently published in the *Journal of Agricultural Research*, Vol. VI, No. 12, June 1916, by Messrs. A. L. Quaintance and A. C. Baker, bringing together all the important information about the distribution and food-plants of thirteen species of Aleyrodidae or white flies which were previously known to attack the orange, with three new species of economic importance. Of the three new species mentioned in the above paper there is one which will be of special interest to all citrus growers throughout the Tropical Americas and the West Indies, since it is already attracting considerable attention in Jamaica, the Bahama Islands, and Cuba.

This insect is known as the Spiny Citrus White Fly (*Aleurocanthus woglumi*, Ashby), although it bears other common names in the different localities where it is prevalent.*

The brief sketch of its early history is taken from the above paper, while later details about this new pest are filled in from other sources, including the writer's personal experience with it in Cuba.

This aleyrodid first came to the notice of the Bureau of Entomology at Washington in June 1910 through material sent from India, and specimens were also received from the Philippines in that year. Then it was found by R. S. Woglum to be widely distributed on orange throughout India and Ceylon.

The first record of its existence in the Western Hemisphere came from Jamaica, when in November 1913 specimens were received at the Bureau of Entomology in Washington from Colonel C. Kitchener near Kingston, and more material was sent in 1914 by Colonel Kitchener and Mr. S. F. Ashby, Microbiologist at the Jamaica Department of Agriculture. The latter was the first to describe this insect, which therefore bears his name after it. Ashby considers that this insect has been introduced into Jamaica on the mango from the East within the last twenty years. A. H. Ritchie, late Government Entomologist of Jamaica, in his report for 1915-16 says, 'The black fly of citrus (*Aleurocanthus woglumi*) continues to spread, and during the past year two of the largest citrus groves in the island have reported attacks of this pest for the first time.' Ritchie finds that this aleyrodid propagates during the entire year in Jamaica, and, as he has seen it, is capable of greater havoc in a shorter period than the two common white flies in Florida combined (the citrus white fly and the cloudy-winged white fly).

The spiny citrus white fly was next found in Cuba in August 1915, and specimens were sent to P. Cardin, Entomologist of the Cuban Agricultural Experiment Station. This material was forwarded to Ashby in Jamaica, identified by him as *Aleurocanthus woglumi*, and in February 1916 verified by Quaintance of the Bureau of Entomology at Washington.

This same insect was reported from the Bahama Islands in February 1916 through material sent by L. J. K. Brace from Nassau (New Providence) to the Bureau of Entomology at Washington. Material preserved in alcohol was also received by the Imperial Department of Agriculture in November 1916 after earlier correspondence about this aleyrodid, which seems to be generally prevalent in Nassau, and is apparently spreading rapidly.

*This insect is also referred to in current literature as the Citrus Black Fly, and the Citrus Blue Fly.

It will be seen from the above account that the spiny citrus white fly has probably been introduced into the Western Hemisphere from the East, and that in this part of the world it is known to occur in the islands of Jamaica, New Providence (Bahamas), and Cuba.

It may be of interest to readers of the *Agricultural News* in general, and citrus growers in particular, to have a few notes on this recently established pest of citrus, and on the work that is already being done to control it in Cuba.

The presence of the spiny citrus white fly in Cuba first became known in August 1915, when it was reported from the Guantanamo valley at the south-eastern end of the island as attacking a few citrus trees in a grove of about 8,000 growing on the Finca Montesano. In the course of an inspection made in the early months of 1916 by the Plant Pathologist and Entomologist throughout the citrus-growing districts of Cuba, it was found that this aleyrodid had spread so rapidly in the above-mentioned grove since August 1915, that practically all the trees were infested. This insect was also found to be prevalent in the neighbouring town of Guantanamo.

Furthermore, this inspection showed that the spiny citrus white fly, in addition to attacking oranges and grape fruit, occurs on other species of citrus, and on several other plants including mango, coffee, guava, sapodilla, star apple, etc. So far as is known at present, the white fly in question only occurs in the Guantanamo valley, where there is very little citrus grown commercially, and has not reached the citrus-growing districts to the north-west.

Prompt measures, therefore, were adopted against this pest with the idea of preventing its spread to the other citrus districts of Cuba. A commission to deal with the more important insect pests and plant diseases of the island was in the process of formation, and the control of *Aleurocanthus woglumi* was among the first problems to be tackled by this commission, as soon as it was established.

A decree was issued by the Secretary of Agriculture forbidding the exportation of any of the above food-plants or any part of them from this infested area, and prohibiting the importation of these plants from India, Jamaica and the Bahamas. Further, all owners of infested properties were required to report the occurrence of the pest and to help in its control by every means in their power. A brief popular circular on this insect was prepared by the Entomologist for distribution, and an edict was drawn up embodying the above-mentioned decree and giving figures of the spiny citrus white fly as seen on the leaves. This edict has been posted up in placard form throughout the infested region, and in other important places in different parts of the island. Before touching on the control measures, it would not be out of place to give a short description of the spiny white fly as seen by the writer in the field. The duties of the field inspection rendered impracticable the working out of a life cycle of this insect, but the following brief notes on the different stages may be of interest.

The eggs when freshly laid appear on the underside of the leaves as minute pearly-white oblong specks, but in the process of development the colour changes through yellow to dark-brown before hatching. Seen from above under a powerful lens they are slightly concave, while from a side view they appear somewhat kidney-shaped. They are usually laid on the younger leaves attached by a short stalk, but can also be found on the older and often heavily infested growth scattered about among the larvae and pupa cases. They are sometimes laid in a spiral form, but are generally deposited without any special arrangement. The hatching larvae soon attach

themselves to the underside of the leaves after the manner of scale insects. They are yellowish at first, but become dark-brown in later stages; the dorsal surface or back is covered with spines. The pupa case is broadly elliptical and dense black with the upper surface arched and armed with many long spines. The adults as seen at rest on the underside of leaves, present a slaty-blue to blue-black appearance, with their rather large front wings arched over the hinder part of the body and almost completely hiding its bright-reddish orange colour. The front wings have whitish markings which under a good lens are seen to be semi-transparent areas, while the smaller hind wings are uniformly dark. This aleyrodid is commonly known in Cuba as the *mosca prieta*, which may be translated 'black fly'. The Spanish name, however, is nearly always used and has been officially adopted.

CONTROL MEASURES.

The control measures against the spiny white fly consisted in spraying the trees with an oil and soap emulsion, and were supervised by the entomologist and an assistant during the first few weeks. To begin with, the following formula was used: whale oil soap, 2 lb.; heavy paraffin oil, 2 gallons; water, 1 gallon. These materials were mixed in the usual way to form an emulsion. One gallon of this concentrated solution was used with each 50-gallon barrel pump. A somewhat larger quantity of soap was used at first to take up any free oil that might tend to scorch the leaves. The amount of soap was gradually lessened after the foliage showed no signs of 'burning'. The main part of the grove consists of medium-sized trees planted in well-spaced rows, which permitted the use of barrel sprayers. These were used at first mounted on low iron wheels supplied with them, but the heavy nature of the soil after rains soon made this method impracticable; the barrels were, therefore, dismounted and used in larger wheel carts with good results. The remaining portion of the grove is planted as a nursery of small trees, which were sprayed by means of knapsack pumps.

When the control work was begun by the entomologist a large portion of the grove presented a blackened appearance, due to the fact that the upper surface of the leaves was covered with the sooty mould which often accompanies a severe white fly infestation, while the underside was thickly encrusted with the black immature stages of the insect. The leaves were in a wilting condition as a result of the continual drain on their vitality. During the early days of the spraying the winged adults were numerous enough to form distinct clouds as they rose to escape the spraying machine.

The writer, as Assistant Entomologist from the Experiment Station, took on the work when the second spraying was nearly completed, and the general improvement on the above conditions was very marked. The trees were resuming their normal healthy and vigorous appearance, and were putting forth an abundance of new shoots. It was on these younger leaves that most of the adults that had survived or had recently emerged were to be found, and numbers of eggs had been freshly laid. With the aid of a good lens it was seen that the larval and pupal stages had suffered heavily, and that a large percentage of the eggs had shrivelled up before hatching. However, the numbers of all stages that still survived were large enough to necessitate a third spraying, which followed immediately on the second. This third spraying killed numbers of the adult white flies just at the time of emergence from their pupa cases when they are in a helpless state and unable to escape by a quick flight. The immature stages, particularly the freshly laid eggs, seemed to

have been fairly well destroyed by the spray. Still better results would have been obtained had it not been for the exceptionally wet season, which not only delayed the transportation of fresh supplies from time to time, but eventually caused a temporary suspension of the spraying operations themselves. The writer during most of his stay in the Guantanamo district was engaged in field inspection work, and could only take note of the spraying work in the intervals between trips. The control work, however, could fortunately be left in the hands of two competent assistants, who carried the operations through in spite of many difficulties. Not the least of these was the fact that the scene of operations was some 500 miles from the base of supplies.

OBSERVATIONS CONNECTED WITH THE INSPECTION WORK.

The main object of the inspection work was to determine as far as possible the limits of the spiny white fly within the Guantanamo valley in order that proper measures might be adopted for restricting it within the determined area.

The valley, about 200 square miles in extent, falls naturally into two distinct regions: a broad rather flat eastern district, which is devoted almost entirely to sugar-cane, and a narrow and more mountainous portion where coffee, cacao, bananas, etc. are grown, often in mixed groves. With the exception of the Finca Montesano, where the control work against the spiny white fly is in progress, and one or two smaller fincas also attacked by this insect, there are no continuous areas where citrus is grown commercially.

Plants of the citrus genus, however, mostly oranges and grape-fruit, are to be found throughout the valley, being fairly thick in the towns and villages, but only very sparsely scattered in the sugar-cane district and among the mixed groves mentioned above.

The inspection of the main portion of the valley, which was done by the writer and an assistant mostly on horseback, showed that practically all the citrus trees within a well defined area of the valley and foothills were more or less infested with the spiny white fly, while other plants such as mango, guava, etc., were occasionally attacked.

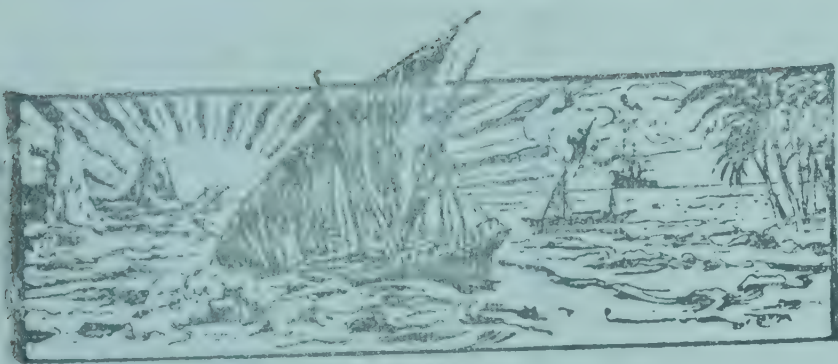
It will be seen that the spiny white fly must be carefully watched for in the tropical Americas, including the West Indies, and especially in the citrus-growing regions. Its great rapidity of dispersion under favourable conditions makes it a potential pest, which, given a fair start, is capable of inflicting considerable damage in a comparatively short time.

J.C.H.

TONS CANE PER TON SUGAR.

A modern sugar factory is capable of recovering some 87° to 89° per cent. of the sucrose in the cane in the form of commercial (96°) sugar. The manner in which the work of the factory is influenced by the saccharine richness of the cane is shown in the following table, which is based on the assumption that the factory turns out 87 lb. of 96° sugar for every 100 lb. of sugar in the cane:—

Per cent. sucrose in cane.	Sugar (96°) from 100 cane.	Tons cane per ton sugar.
10	8.70	11.50
11	9.57	10.45
12	10.45	9.58
13	11.31	8.85
14	12.18	8.21
15	13.05	7.66
16	13.92	7.19



GLEANINGS.

According to the *International Sugar Journal* for November 1916, the European sugar beet crop estimate showed a reduction, being some 60,000 tons less than 1915. It appears that the total production for 1916-17 will be 5,150,000 tons.

The Rangpur lime as grown in Montserrat, has an average weight of 61 grammes and yields 50 per cent. of juice. The fruit resembles in appearance a coarse-skinned tangerine, and tends to cling to the tree and not to drop as in the case of the West Indian lime.

A trial made in Montserrat showed that fairly reasonable crops of both ground nuts and corn can be obtained simultaneously from the same area. The seeds of both were planted at the same time, the ground nuts being placed midway between the rows of corn. This intensive form of culture of provision crops is to be encouraged.

It is stated in the Report on the Agricultural Department, Montserrat, for 1915-16, that a four-year-old Bay tree plantation ought to produce about 20 lb. (equivalent to 2 gallons) of oil per acre, if attention has been paid to the cultivation of the trees during the first two years. This return should increase to 40 lb. of oil per acre at about the sixth year. Interest in the planting of further areas in Montserrat continues active.

The *Agricultural Gazette of New South Wales* contains two articles dealing with drought-resistant grasses. Experiments with elephant grass or Napier's fodder grass (*Pennisetum purpureum*), and Rhodes grass (*Chloris gayana*) are described. Both of these fodders can be produced in areas of low rainfall. Rhodes grass does not appear to prove as palatable however as elephant grass. Both of these grasses have been experimented with in the West Indies.

An article in the *Trinidad Mirror* for December 11 refers to the profitable nature of the Government Experimental Farms, namely, River estate and St. Augustine estate, in that Colony. In spite of heavy expenditure at River estate during 1915-16, there was a net saving of \$500, which leaves a balance to the credit of over \$4,000. St. Augustine estate is also shown to be a profitable undertaking as well as the scene of a large amount of valuable work.

The monthly return for September 1916, showing the state and prospect of the Egyptian cotton crop, indicates the higher prices obtaining for Sakellarides compared with the prices at the same time last year. This is of interest in connexion with the general rise in the Sea Island cotton market. It appears that, on the whole, the yield of the Egyptian cotton crop this year (1916) is appreciably below the average—the result of abnormal climatic conditions.

Experiments conducted in Montserrat show very clearly the advantage of providing supports when one of the objects in cultivating the fleshy pod bean (*Stizolobium pachylobium*) and the white velvet bean (*S. Deeringianum*) is the production of a crop of pods as well as a green dressing. In the case of the white velvet bean, the staked plants yielded at the rate of 2,028 lb. of shelled beans per acre compared with only 520 lb. from the unstaked section. Similar results were obtained in the case of the fleshy pod bean.

A copy has been received of the Annual Report of the Camel Specialist to the Government of the Punjab, India, for 1915-16. This states that a large number of experiments were carried out on the treatment of surra by various substances, and that further experiments with anti-fly emulsion were carried out together with experiments to determine the susceptibility of camels to rinderpest, hæmorrhagic septicæmia, and black-water.

Experiments on the application of lime to the soil, conducted with different crops in the Federated Malay States, have indicated that a decided improvement in crop production can be obtained by the application of lime in quantities not sufficient to neutralize entirely the acidity of the soil. Such improvement has not been found to be directly proportional to the reduction of acidity. The results indicate that an application of 1 ton of burnt lime (calcium oxide), say, every four years, will give the best returns.

A review appears in *Nature* for November 2, 1916, of a new text-book on agricultural geology, by R. H. Rastall, published at the University Press, Cambridge. It is stated to be a well written treatise on geology for agricultural students, and that a feature of the book is the chapter on the geological history of the domestic animals, which so far has not usually been considered in the teaching of agricultural geology. Attractive descriptions of the types of country met with on various formations throughout England are given.

The *St. Lucia Official Gazette* for November 4, 1916, contains the report of the commission appointed to enquire as to the amount and sufficiency or otherwise of the food and grain supply in that colony. In this it is urged that all landholders, both large and small, should be induced to increase local production of such crops as maize, Guinea corn, cassava, sweet potatoes, plantains, and other similar crops, which are capable to some extent of taking the place of wheat flour. In St. Lucia, beef and mutton have risen by 2d. in the £ during the last six months; other foods have also increased in proportion.

The scarcity of potash has stimulated enquiry into the possible new sources of this mineral. One of the latest suggestions is the production of potash salts from olive oil residue (the blackish turbid liquid deposited at the bottom of the sink under oil presses), which contains about 1.5 per cent. or slightly more. It is stated in the *Journal of the Department of Agriculture of Victoria* for October 1916, that by evaporation and combustion of 100 gallons of this residue, 30 to 35 lb. of ash are recovered. Roughly, 10,000 gallons of this liquid would produce, on the figures given, approximately 1½ tons of ash, the potash content of which would make it worth £2 10s. per ton at the present high price of potash.

THE GOLD COAST.

A very instructive paper by Mr. A. E. Kitson, Director, Geological Survey, Gold Coast, comprising considerations of the Colony's structure, people and natural history appears in the *Geographical Journal* for November 1916. In view of the great importance of the Gold Coast as a cacao-producing country, and the bearing which this has upon the West Indies, it may prove of interest to record in this Journal some of the observations which Mr. Kitson makes.

At the outset reference is made to the rapid advance which the country is making in every way. Railways are being steadily extended into the rich agricultural districts, and bringing quickly to the ports, Accra and Sekondi, their rich products, especially cacao. It is pointed out that the cacao-growing industry has increased nearly ten-fold in the last ten years. In annual value of exports it now takes first place, having superseded gold. It is still rapidly expanding, and the writer is of opinion that if the native farmer could be induced to realize the necessity for adopting better methods of cultivation and sanitation, there would be practically no limit to the expansion of the industry.

The paper then goes on to describe the climatic conditions, and the different sections into which the country is divided geographically. The intermediate region consisting in the main of the dissected plain rising northward from the coast to a height of about 900 feet, embraces the main thick forest belt of the country, and is the principal farming and cacao-growing country, and furnishes most of the wild rubber, kola nuts, and mahogany of the colony. The mahogany logs are cut in the forest and dragged by teams of labourers over rollers of wood to the railway, or to streams down which they are floated in the rainy season to the sea.

In describing the geographical section of the country known as the interior plains, it is said that this has the general character of a well open forest of low trees with patches of high grass, and of wide expanses of grass almost or wholly devoid of small shaggy trees. During the dry season following the rains, the natives cut as much of this grass as they want and burn the rest. This seasonable burning of the country has its advantages and its drawbacks. Without burning the grass, progress through the country in many places would be extremely slow and laborious, and travel would need to be confined to overgrown native paths or the tracks of large game. Farm lands could not be so easily worked, and millions of insects would escape destruction. But, on the other hand, vast numbers of young trees are destroyed, and none but the hardiest as a rule survive the fiery ordeal.

Much of what immediately follows concerns more particularly the geology of the country. That relating to the inhabitants of the country is of general interest, while that concerning the occurrence of minerals is important. Regarding the occupation of the people, it should be noted that besides agriculture, there is a good deal of hunting, spinning and weaving locally grown cotton, wicker working, leather working, salt making, pot making, and bee keeping. An important industry along the coast is fishing, while in the northern territories the food supply of the country is catered for by the natives who rear sheep, goats, cattle, and fowls, and bring them down regularly every dry season to the big markets in Coomassie. The stock routes, as they are called, are the scenes of many deaths of both man and beast. Water is frequently unavailable, bush fires prove sometimes dangerous, while the mosquito, and particularly the tse-tse fly, are a grave menace to health.

Considerable space is devoted in the paper to an enumeration of the indigenous plants of economic value or use in the country. Reference is made to oil nuts, to the

Dawa dawa, a long bean like the locust bean, which has a rather sweet yellow pulp, which is eaten when ripe, while the seeds are crushed and made into a thick paste and sold. The piassava, or wine palm, found only in the moister country, is tapped for wine, and is used largely for baskets, canoe poles, thatch for houses, and cords. In this connexion, although arrowroot is very common in the wet zone, it is not apparently used as a food, though its leaves are used for thatching. Commonly cultivated plants include cacao, plantain, banana, yam, coco yam, cassava, sugar-cane, maize, millet, ground nut, coco-nut, bean, rice, and all the vegetables and fruits common in the West Indies. There is a prospect of developing a valuable copra industry on the Gold Coast. Millet, ground nuts and the better tobacco are grown in the more open and drier districts of Ashanti and the territories. Excellent rice is grown in the country.

Turning to the zoological characteristics of the country, it is stated that lions are to be found in parts of the northern territories and Ashanti, while leopards and other Felidae are common in the thick forests and the open forest country where caves afford shelter. The mongoose is plentiful in the drier parts of the country. Of big game there appear to be large quantities which furnish material for hunting. Baboons are very numerous in the dry country, and in common with the larger antelopes and elephants, do a great deal of damage to farms located some distance from villages. These are such a pest in some districts that no foodstuffs can be raised except immediately around the houses of the villages. A company of fifty to 100 baboons, or a herd of elephants will clear a field of maize in a few minutes, destroying much more than they can eat.

The writer of the paper under notice then gives an account of the birds and reptiles. Coming to insects, he states that the ants are the most interesting insects in the country. There are several kinds that deserve special mention. Foremost are the drivers, with their highly organized communal system and ceaseless energy. Foraging ants in small parties or companies raid the home of other insects. Pale-brown tree ants infest certain kinds of trees, among them the kola. There are also the small black ants and the large dark stench ants. Termites are also a nuisance in some parts of the country.

This concludes the information contained in the paper that is likely to prove of interest to the general reader of the *Agricultural News*. We cannot conclude without congratulating the writer upon the exceptionally fine photographs, taken by himself, with which the paper is illustrated. These photographs give a very good general idea of the scenery and geology and people of the country.

In an article on rhododendrons and lime, *Nature* for February 17, 1916, makes reference to the discovery of rhododendrons growing on limestone rock in India. As a general rule species of rhododendron are chalk-avoiding plants. The abhorrence of lime by the humus-loving rhododendrons appears to be intimately connected with the symbiotic fungus which lives in association with the roots of the rhododendron and heath family (Ericaceae), and performs the function of the root hairs in absorbing water from the soil; and it may be that the fungi associated with the mycorrhiza of the humus-loving form of rhododendron are physiologically, if not specifically, distinct from those of lime-tolerant species.

PLANT DISEASES.

SUMMARY OF NOTES ON FUNGI AND PLANT DISEASES.

The following is a classified summary of the information given in this Journal under the headings Fungus Notes and Plant Diseases during the year 1916.

SUGAR-CANE. The occurrence of a disease apparently identical with the wilt disease of India, caused by the fungus *Cephalosporium sacchari*, is recorded (pp. 14, 46) for Barbados and Nevis. Another Indian disease, due to *Cytospora sacchari*, affecting leaf sheaths and young shoots has appeared in Porto Rico (p. 270).

CITRUS TREES. Further information as to citrus canker, the result of experience and experiment in Florida, is summarized on page 142. The view is confirmed that the disease is caused by the bacterium *Pseudomonas citri*, and evidence is given which shows the organism to be capable of retaining its vitality for considerable periods spent in the soil or in a dry condition on exposed surfaces. A careful search for citrus canker in Porto Rico (p. 270) has led to the conclusion that the island is so far free from infection.

The liability of citrus trees to forms of die-back apparently connected with irregularities of growth, conditioned by climate and food supply, is discussed on pages 366-7 on the basis of a Queensland report describing troubles of this nature closely parallel to those experienced in some parts of the West Indies.

A type of dry sunken spot on the rind of oranges, which had received some attention in Dominica, has now been shown by experiments in California to be due to the escape of essential oil on to the surface of the fruit (p. 62).

Affections of lime seedlings, comprising the common 'damping-off' disease, and a disease due to a fungus of the 'downy mildew' type, are the subject of notes on page 414.

COTTON. An article affording further information on the internal disease of cotton bolls appeared on pages 126-7. It supplies further evidence as to the dependence of the disease on the pricking of the boll by the cotton stainer or the green bug. A discussion of this subject at the Cotton Conference held in St. Kitts is reported on pages 182-3.

OTHER CROPS. The obscure disease of pine-apples known generally as wilt, has given some trouble in Montserrat during the year, and is the subject of an article on pages 174-5. A summary is given (p. 94) of observations made in Trinidad on the anthracnose of the mango, which is responsible for considerable loss of fruit when the weather conditions favour the spread of the causative fungus. On page 318 information is given concerning the mode of attack of *Ustilina zonata* on Hevea stems. A disease of alfalfa in Montserrat is noted on page 414.

FUNGICIDES. In continuation of an article in the previous volume on Burgundy mixture, the results of trials of adhesives and preservatives are reported (p. 30). The addition of milk or resin soap gives such a great advantage in respect of adhesion that one or the other should be generally used. The preparation and use of sodium arsenite for the purpose of killing weeds and trees are described on page 254. A note on the effect of sulphur on crops appears on page 78.

ENTOMOGENOUS FUNGI. The year has been an interesting one in respect of the number of insect-destroying fungi recorded, new to science or new to the host or locality. Those which have been observed in St. Vincent include *Cordyceps peltata*, Wakefield, on *Cryptorhynchus corticalis* boring in *Codiaeum* (p. 110), an *Isaria* on a grub of either

Diaprepes or *Exophthalmus* (p. 110), *Sporotrichum globuliferum* on the cacao thrips (pp. 110, 430), and several fungi on scale insects (p. 110). It may be recorded here that St. Vincent has also yielded an *Isaria* on the mole-cricket, collected by Mr. S. C. Harland. From Montserrat several collections have been received of an undescribed *Empusa* which lives as an internal parasite of the green scale, *Coccus viridis*, and seems to kill off large numbers of the insect.

CACAO. Cacao die-back, connected with lack of 'shade' and lightness of soil, is discussed in a report on a visit to St. Vincent printed on pages 206-7 and 222-3.

W. N.

IMPROVEMENT OF INDIAN CORN IN ST. VINCENT.

The following account of the work in connexion with the improvement of Indian corn in St. Vincent is taken from the Annual Report of the Agricultural Department for 1915-16:—

During the past season experiments have been carried out with the object of improving the native types of corn. The latter are very numerous, and differ in respect of every measurable character; in fact no two plants are alike. In general the grains may be yellow, white, red, or brown in colour. There is sub-division again into Dent and Flint types, and a further separation can be made according to the size and shape of the grain.

In respect of maturity they are early, being usually ready to reap in ninety to 100 days. In height, they are from 3 to 5 feet, and this is a desirable quality, since taller varieties suffer greatly from strong winds.

The maximum amount of grain per ear when grown under good cultivation, appears to be not more than 7 oz., which seems very small when compared with results obtained from other countries. After four generations of selection no increase whatever has been obtained in the maximum amount of grain per ear, although much uniformity has been obtained in other respects. It is therefore fairly safe to assume that the native breeds are by nature small, and it is not possible to form combinations of gametes leading to the production of the enormous ears recorded from other localities.

In this connexion the remarks of Burt-Davy are of interest:—

'Poorly bred seed, moreover, is apt to produce barren stalks and small ears yielding perhaps only 3 oz. of grain apiece. A plant that does not produce 8 oz. of grain is not giving an adequate return for the time and care bestowed upon it, nor for the space that it occupies. In view of the fact that 8 oz. of grain per ear is a common return, and that ears yielding 15 oz. of grain are not unknown, an average of 3½ oz. is absurdly low, and suggests great possibilities for improvement.'

At present the average yield per stalk in St. Vincent is certainly below 3½ oz., and a heavier yielding type is much needed.

CORN IMPROVEMENT.

The work of corn-improvement is developing along the following lines:—

(1) *The production of a uniform yellow corn.*

The first crop from ears selected from various parts of the island contained only 55 per cent. of yellow ears, the rest being various shades of red. Three generations of mass selection reduced the number of red ears to less than 5 per cent. The red colour is found in the pericarp, and it is consequently a plant character. Ears which are outwardly yellow may be heterozygous, and segregation takes place into reds and

yellows when these ears are planted. It is thus impossible to eliminate reds without self-fertilization.

A number of selected plants were self-fertilized. The progeny of some consisted only of yellow ears, while others contained more or less red. Selection was continued from the pure yellow, and thus the percentage of reds was still further reduced (to about 2 per cent.).

To obtain an absolutely pure yellow strain, all the grain from the selfed ears should not be planted. From the behaviour of the plants from, say, 100 grains, the purity of the colour can be judged. The remainder of the grains from ears that have shown themselves to be pure yellows can then be planted in an isolated position to increase the type. This method is being adopted with the hybrids which are being studied, of American Yellow Dent by St. Vincent Native corn. Further details of these experiments will be found below.

(2) *To increase the size of grain and the amount of grain per ear.*

An increase in the amount of grain per ear implies an increase in the yield of shelled corn per acre. It has been pointed out that in general, under St. Vincent conditions, the average yield of grain per ear is under 3½ oz. even when good cultivation is practised. This is chiefly due to the fact that the natural size, both of the ear and the grain, is small, and it does not appear to be possible to raise the standard very considerably by selection alone. Ears with more than 6 oz. of grain are uncommon.

To increase the amount of grain per ear, a number of the best ears, i.e. those giving the greatest weight of shelled grain, have been selected for planting during four generations. No marked increase has been noticed in the size of the grain or in the maximum amount of grain per ear, although the average weight per ear is decidedly greater.

In conjunction with the above, the practice is followed of detasselling all plants which are obviously weak and undesirable. A marked diminution in the number of these types has resulted.

The Dent types grown in the United States frequently yield from 75 to 100 bushels per acre, and higher yields even than these are not uncommon. When these types are grown in the West Indies they are usually a failure. The plants are weak and sickly, and are more subject to the attacks of various insect pests than the native varieties. This has been the experience in all the West Indian islands where they have been tried. In certain islands, notably Antigua, good strains of corn have been secured through the hybridizing of suitable American varieties.

During the past season two crosses have been made: (1) Long's Yellow Dent × Native, (2) an American Flint × Native.

The first generation of the first of these crosses has been grown and all the plants self-fertilized. The plants were remarkably vigorous and showed segregation in respect of many of the grain characters. The size of many of the ears was much greater than that of the native types.

It is satisfactory to notice that the press as well as the Governments in the different islands are ventilating the West Indian food question. The *Dominica Guardian* for November 30, as the result of the circular letter issued from the Imperial Department of Agriculture to the Administrations, contains an editorial in which reference is made to the efforts that are being put forward in Antigua to increase the amount of provisions grown. The *Guardian* suggests that more ground provision planting material should be raised and distributed from the Botanic Gardens in Dominica.



WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKETS.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets, for the month of November:—

The condition of business in the produce markets during the month of November has remained pretty much the same as that recorded in our last report. If there has been any perceptible change it has been rather in prices than in the quantities brought forward. The following are some of the principal details.

GINGER.

At the spice auction on the 22nd of the month, the offerings of ginger amounted to 374 bags of washed Cochin, all of which were disposed of: fair rough realized 46s. per cwt. and wormy 42s. 6d. to 43s., which prices were an advance of 2s. per cwt. on previous rates.

NUTMEGS AND MACE.

At the spice auction on the 15th of the month, there was the very large supply of 1,163 packages of West Indian nutmegs offered, the bulk of which was disposed of at advanced rates of 2d. to 3d. on previous prices. At the same sale there was also an abundant supply of mace, as many as 358 packages being brought forward, and sold at advanced rates.

SARSAPARILLA.

At the auction on the 16th, sarsaparilla was represented by 30 packages of grey Jamaica, 16 of native Jamaica, 12 of Honduras, and 50 of Mexican. Of the first, 18 packages were disposed of, fair fetching 1s. 10d. per lb. and ordinary 1s. 9d.; the whole of the Honduras found buyers at rates varying from 1s. 6d. to 1s. 9d. per lb. The Mexican and native Jamaica were both entirely neglected.

CITRIC ACID, LIME OIL, KOLA, ANNATTO SEED, AND CASHEW NUTS.

The quotation for citric acid at the beginning of the month was 2s. 6d. per lb., and at this figure large quantities changed hands. A week later, however it had dropped to 2s. 5d., but at the end of the month the average price was 2s. 6d. At the first auction on November 2, it was reported that the large consignment of 160 packages of West Indian lime oil had arrived, and a portion had been disposed of at 11s. for hand-pressed and 9s. for distilled, prices which were maintained to the end of the month. Kola was a prominent article at auction on the 16th, being represented by 256 packages; the bulk of this consignment consisted of mouldy and damaged from Jamaica, and was bought in. Four bags of small Java fetched 4½d. per lb., and at another auction it was reported that some dozen bags of West Indian had realized 5d. to 5½d. per lb. Some 5 packages of annatto seed were offered at auction on the 16th of the month, but none was sold. It was reported that 8d. per lb. was the price at which fair Madras was to be obtained. Cashew nuts were also in good supply at the same auction; 76 packages were offered but there were no buyers.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
November 30, 1916.

ARROWROOT—2 $\frac{3}{4}$ d. to 3 $\frac{3}{4}$ d.
BALATA—Sheet, 3/5 to 3/6; block, 2/3 $\frac{1}{2}$.
BEESWAX—No quotations.
CACAO—Trinidad, 81/- to 83/-; Grenada, 70/6; Jamaica, 67/- to 70/-.
COFFEE—Jamaica, no quotations.
COPRA—£40 to £41.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 16d. to 23d.
FRUIT—Bananas, £17 per ton; Oranges, Jamaica, 16/- to 17/- per case.
FUSTIC—No quotations.
GINGER—Jamaica, 85/- to 105/-.
ISINGLASS—No quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 2/6; concentrated, £22; Otto of limes (hand-pressed), 10/- to 11/-.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—3 $\frac{3}{4}$ d. to 3 $\frac{1}{2}$ d.
RUBBER—Para, fine hard, 3s. 4d.; fine soft, 3/1; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., December 21, 1916.

CACAO—Caracas, 15 $\frac{1}{2}$ c. to 16 $\frac{1}{4}$ c.; Grenada, 14 $\frac{3}{4}$ c. to 15c.; Trinidad, 14 $\frac{1}{2}$ c. to 15 $\frac{1}{4}$ c.; Jamaica, 11 $\frac{3}{4}$ c. to 11 $\frac{1}{2}$ c.; Ordinary, 12c. to 12 $\frac{1}{4}$ c.
COCO-NUTS—Jamaica and Trinidad selects, \$33.00 to \$35.00; culls, \$22.00 to \$23.00.
COFFEE—Jamaica, 9 $\frac{1}{2}$ c. to 11 $\frac{1}{2}$ c. per lb.
GINGER—15c. to 18c. per lb.
GOAT SKINS—Jamaica, \$1.00 to \$1.15; Antigua and Barbados, 95c. to \$1.10; St. Thomas and St. Kitts, 90c. to \$1.00 per lb.
GRAPE FRUIT—Jamaica, \$1.25 to \$1.50.
LIMES—\$4.00 to \$4.50.
MACE—45c. to 52c. per lb.
NUTMEGS—19c. to 26c.
ORANGES—\$1.50 to \$2.00.
PIMENTO—5 $\frac{3}{8}$ c. to 5 $\frac{1}{2}$ c. per lb.
SUGAR—Centrifugals, 96°, 5.14c; Muscovados, 89°, 4.48c.; Molasses, 89°, 4.14c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., December 15, 1916.

CACAO—Venezuelan, \$13.70 to \$14.00; Trinidad, \$13.50 to \$13.75.
COCO-NUT OIL—\$1.07 per Imperial gallon.
COFFEE—Venezuelan, 14 $\frac{1}{2}$ c. to 15c.
COPRA—\$6.25 per 100 lb.
DHAL—\$7.00.
ONIONS—\$4.50 to \$5.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$5.00 per 100 lb.
RICE—Yellow, \$7.25 to \$7.75; White, \$7.40 to \$7.75 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. JAMES A. LYNCH & Co., Ltd,
December 13, 1916; T. S. GARRAWAY & Co.,
December 27, 1916

ARROWROOT—\$5.00 per 100 lb.
CACAO—\$14.00 to \$15.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—\$1.75 to \$1.80 per 100 lb.
MANURES—Nitrate of soda, \$90; Cacao manure, no quotations; Sulphate of ammonia, \$110.00 to \$112.00 per ton.
MOLASSES—No quotations.
ONIONS—\$6.00.
PEAS, SPLIT—\$9.75 per 210 lb.; Canada, \$6.00 per 120 lb.
POTATOES—Nova Scotia, \$4.25 to \$6.00.
RICE—Ballam, \$7.58 to \$7.95; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$5.25 to \$5.50.

British Guiana.—Messrs. WIETING & RICHTER, November 30, 1916; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	MESSRS. WIETING & RICHTER.	MESSRS. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	\$11.00	
BALATA—Venezuela block		
Demerara sheet	\$65.00	
CACAO—Native	15c. per lb.	
CASSAVA—	96c.	
CASSAVA STARCH—	\$9.00	
COCO-NUTS—	\$20 to \$24 per M.	
COFFEE—Creole	14c.	
Jamaica and Rio	15c. per lb.	
Liberian	11c.	
DHAL—	\$6.50 to \$7.25	
Green Dhal		
EDDOES—	96c.	
MOLASSES—Yellow	None	
ONIONS—Teneriffe	2c.	
Madeira	5c.	
PEAS—Split	\$12.00 to \$12.50	
Marseilles		
PLANTAINS—	32c. to 60c.	
POTATOES—Nova Scotia	\$5.00 to \$5.25	
Lisbon		
POTATOES—Sweet, B'badon	\$1.92	
RICE—Ballam	\$7.00	
Creole		
TANNIAS—	\$2.88	
YAMS—White	\$2.40	
Buck		
SUGAR—Dark crystals	\$4.50 to \$4.70	
Yellow	\$5.00 to \$5.10	
White	\$7.00	
Molasses		
TIMBER—GREENHEART	48c. to 72c. per cub. foot	
Wallaba shingles	\$5.50 to \$7.50 per M.	
„ Cordwood	\$3.00 to \$4.00 per ton	

NO QUOTATIONS.



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Green-Manuring Problems.

IF recent years the subject of green manuring appears to have received less attention than formerly. In the West Indies this is probably due to the fact that this method of fertilizing the soil has been largely given up on many estates as a result of the introduction of cotton and other quick-growing crops of commercial value. It is very much open to question whether green manuring ought not to be more extensively practised. The difficulty is, we are very much in the dark as to the real value of this method, as to what the effect of the manure on the soil and succeeding crop really is, and to what extent the usual method of turning in the green crop is

effective and economical. At the present time, and for many years past, trials have been made with green dressings at the West Indian Experiment Stations, but these trials have merely consisted in growing the crops to test their yielding capacities, etc.—the work has not had regard to the many matters concerning application of the dressing to the soil, on which at present we are almost entirely in the dark.

In general practice the application of green vegetable matter to the soil falls under two categories: (a) arable application where the dressing is turned in in the field where it grew; (b) orchard application where green material is collected or especially grown apart from the orchard, and applied at a definite rate around the bases of the cacao or citrus trees. There are also modified methods of applying the dressing indirectly by placing it in cattle pens, where it is partly eaten and partly trodden in with the manure of the cattle; or the dressing may be cut in the field and applied in conjunction with a complementary dressing of pen manure. All these forms of application present special problems that require solution. They open up important lines of investigation that could very well be followed up at West Indian Experiment Stations.

Considerable light seems to be thrown on the subject of green manuring by C. M. Hutchinson's work in India.* It has been found that the complete decomposition of a green crop depends upon the incidence of the rainfall following its burial. This being frequently defective, an attempt was made to see if negative results could be avoided by carrying out the initial stages of the decomposition under artificial conditions. It was assumed that decomposition must proceed, to

*See *Bulletin* No. 53 (1916), Agricultural Research Institute, Pusa—'A modified Method of Green Manuring'. By C. M. Hutchinson, B.A., Imperial Agricultural Bacteriologist.

give beneficial results, in such a way, and to such a degree, as to result in the conversion of the organic nitrogen of the green manure into nitrate, and the breaking down of the cellulose and lignified tissues so as to result in the addition of humus to the supply already in the soil.

It was found that the most complete breaking down and subsequent nitrification of the plant tissues was obtained by providing an excess of moisture accompanied by anaerobic† conditions during the first stage, followed by a second one of less moisture and semi-anaerobic conditions. The method adopted was to dig pits at the sides of the fields previous to cutting the green crops; this being done during the rains, the pits filled with water; the cut crop was placed in the pits and left there for periods varied experimentally from twenty-four to forty-eight hours, removed from the pits, stacked in heaps, and allowed to ferment for varying periods of time, after which the rotted manure was applied to the soil. Later experiments, however, have shown that owing to the loss of free nitrogen that may occur, it is perhaps advisable to omit altogether the preliminary steeping in water, and commence the preparation of the fermented manure by stacking in heaps, moistening with water, plastering the outsides with clay (kept moist to prevent cracking), and allowing fermentation to proceed as before, without the loss of nitrogen.

It was found that more complete fermentation could be obtained by inoculating the heaps with impure cultures of cellulose-destroying bacteria, obtained simply by making a water extract of fresh cow dung.

An important point to bear in mind in connexion with the fermentation of green manure is that during the preliminary anaerobic stage, toxins are formed which act injuriously upon plant growth. It is therefore necessary to interpose an aerobic stage between the preliminary anaerobic one and the final application to the soil, not only to promote nitrification, but to insure the oxidation and destruction of the toxins produced.

It may be that where a green dressing is ploughed into a heavy soil containing an abundance of moisture, or where persistent rains follow the application of the manure, an anaerobic condition is produced which leads to the production of toxins.

†Aerobic fermentation is that kind of fermentation which proceeds in the presence of air; anaerobic fermentation can only proceed in the absence of air. As used with reference to the decomposition of green dressings and allied manures, these terms are only proximate, since under the conditions referred to, complete aerobism or anaerobism is impossible.

The results of plot experiments with fermented green manure in India indicate that it has a much quicker action than unfermented manure, and very considerable increases in the yield of oats (grain) and tobacco are recorded. The following are the figures obtained in the oats experiment:—

	Grain, lb. per acre.	Straw, lb. per acre.
Control plot ($\frac{1}{4}$ -acre)	885	2,820
Sunn hemp (<i>Crotalaria juncea</i>) ($\frac{1}{4}$ -acre)	960	2,835
Fermented Sunn hemp	1,540	2,970

In the case of the tobacco experiments the preparation of the manure under anaerobic conditions was not carried out in time to allow its application to the soil sufficiently early to avoid toxic effects. The plots, therefore, treated with manure fermented under aerobic conditions (in loose heaps without a covering of wet clay), gave better results. Nevertheless, even the anaerobically fermented manure gave very considerable increases.

Hutchinson, in discussing the results obtained, raises the point as to whether in ordinary estate practice, green manures are always applied at the rate per acre likely to do most good to the particular soil or crop it is desired to benefit. The usual procedure is to grow a green dressing on a certain area and turn it in irrespective of the above consideration. In some cases more than is produced, and in other cases less than is produced, would exert the maximum benefit. This seems a point worth investigating. Obviously the fermentation method allows of such regulation of the amounts applied, as also does the process of green mulching that has been found so beneficial to cacao and limes in the West Indies.

The Indian work would appear to indicate that after the application of green mulch to the surface of the soil round cacao trees, some sort of aerobic fermentation will take place. It is a question whether anaerobically fermented green stuff spread around the trees might not show quicker results, more in accordance with the action of certain chemical manures.

Enough has been said to indicate the sort of green-manuring problems that need to be attacked in the West Indies. In concluding it may be noted as being of particular West Indian interest, that in India attention is being given to the possibility of fermenting sugar-cane stumps and trash by the method that has been described in this article. In most of the sugar-cane districts of India the stools have to be collected and burnt before a succeeding crop can be grown. It

would involve little additional labour to pit and rot them. These stools contain a considerable amount of saccharine matter, and would possibly form an excellent medium for bacteria.

ABSORPTION AND LOSS OF NITROGEN IN CONNEXION WITH SUGAR ESTATES.

The *International Review of the Science and Practice of Agriculture* (June 1916) contains the following summary of work in Java to determine to what extent nitrogenous manures are made use of by sugar-cane.

The question of the absorption and loss of nitrogen in the soil after the application of nitrogenous manure is of prime importance in the cultivation of the sugar-cane in Java, where every year at least 50,000 tons of sulphate of ammonia are used, costing about £635,000 for a cultivated area of 246,954 acres.

In a series of specimens from different districts under sugar-cane, the loss of nitrogen occurring on mixing a solution of sulphate of ammonia with the soil was determined.

For the purpose of analysis 50 gms. of dry earth are first mixed with 50c.c. of water and the whole afterwards with 50c.c. of a one-fifth normal solution of sulphate of ammonia. The mixture is regularly shaken up for two days, then filtered, and, by distillation, the amount of ammonia in 20c.c. of the filtrate is ascertained. Multiplying by 14 the number of cubic centimetres of decinormal ammonia obtained by distillation (it should be below the limit 20), the coefficient of absorption of nitrogen is ascertained.

Analyses made, show that for the majority of soils with a coefficient of absorption exceeding 140, no loss need be feared. Some lands with a coefficient below 80 might sustain a loss under particularly unfavourable circumstances, such as torrential rains or floods.

Soils of coarse texture have a low coefficient of absorption and a fairly considerable loss of nitrogen. On applying a heavy dressing of manure, the loss of nitrogen increases.

On determining the coefficient of absorption by a given soil, it may be ascertained to what extent manuring with sulphate of ammonia may be effective without entailing a considerable loss nitrogen

Contrary to the nitrogen in sulphate of ammonia, that of nitrates is not absorbed by the soil. It having been necessary, owing to the present war, to replace sulphate of ammonia by nitrates in sugar-cane plantations, it was thought desirable to study the various soils utilized for sugar-cane growing from the stand-point of absorption of the nitrogen from nitrates.

It was found that none of the soils analysed had any high coefficient of absorption. On subjecting the same soils with nitrate added, to leaching for three days, a considerable quantity of nitrogen from the nitrate, it was found, had been leached out.

The conclusion drawn from the investigations is that the use of nitrate of soda in tropical countries during or before the rainy season is of no advantage. [These findings have reference to heavy rains capable of washing the nitrate out of the soil.] The employment of nitrate of potash on permeable, highly irrigated soils, is also not to be recommended.

In Europe, the action of nitrates is more rapid and effective than that of sulphate of ammonia. In the tropics, where nitrification is so rapid, this difference in the behaviour of sulphate of ammonia is unimportant.

INTERESTING HORTICULTURAL WORK IN HAWAII.

The *Experiment Station Record*, Vol. XXXV, No. 6, gives an account of recent work at the Hawaii Agricultural Experiment Station, in the following words:—

The station is co-operating in experiments in Florida and in California with the view of extending the culture of litchi (*Litchi chinensis*). Some successful experiments in transporting these short-lived seeds under refrigeration from Honolulu to San Francisco, and thence by ordinary express and by mail in moist sphagnum moss to Washington, D.C., and to various localities in California are noted. All of this seed germinated well, thus indicating that litchi seeds may be transported where refrigeration for fruit is available.

In the work with mangoes some preliminary studies have been made on the flowers of certain varieties, and on methods of pollination. Several mango seedlings less than nine months old, which had been grafted by inarching, were found to be producing flower clusters above the point of union, and in most cases the scion also was flowering. The mango tree ordinarily does not flower until it is from five to six years old. No cause is ascribed for these phenomena, except the grafting. An instance of bud mutation is reported, in which a single branch of one of the trees bearing green fruit produced a pink fruit rather smaller in size than the regular type, but otherwise resembling the variety. Bark grafting the mango, which has previously been successfully applied by the Porto Rico Experiment Station, has proved to be well adapted under Hawaiian conditions to the work of top grafting established trees. The process is here described.

In the work with avocados, the Macdonald, the parent tree of many of the round, hard-shelled winter seedlings, has attracted some attention by its remarkable keeping qualities. The fruits were kept in the horticultural laboratory for sixteen days without any refrigeration, being in a perfect state of preservation at the end of this time.

In the work of propagating the avocado, scion budding has given satisfactory results. The scions are inserted in a T-shaped incision similar to that made for shield budding, only much larger. After being tied in place the budded scion is waxed with a firm grafting wax which will not run when heated by the sun. This method is considered to be advantageous as a means of propagating from old bearing trees which frequently do not produce good bud wood unless severely cut back. It may also be used to work branches of considerable size. Observations of apparently multiple-stemmed seedling avocados showed that such seedlings have a single central stem, the other stems arising from buds on this stem beneath the surface of the ground, and in many cases within the seed.

The work of breeding papayas was resumed along lines previously noted. A number of crosses and close pollinations have been made to secure information on questions arising in earlier work.

In the citrus orchard many varieties are now in bearing and making a satisfactory growth. Practically all of these varieties have been introduced as a bud wood and work upon home-grown stocks.

In view of the claim by some manufacturers that a blend of the oil of kukuri (*Aleurites moluccana*), and of the China wood oil (*A. fordii*) is preferable to either one, some work was undertaken by V. S. Holt in hybridizing these species with the idea that the new forms might combine the desired characters in a way superior to either of the parents. A number of fruits from these cross pollinations have been secured.

ORIGIN OF THE NAVEL ORANGE.

In 1913-14, an agricultural expedition to southern Brazil was organized by the United States Department of Agriculture, to collect all available information concerning the navel orange, particularly at Bahia, from which point the parent Washington navel trees were sent to the United States. The observations and conclusions of the expedition (briefly referred to in the *Agricultural News* for November 4, 1916), which should not be without interest to persons concerned with citrus cultivation in the West Indies, are summarized in the *Monthly Bulletin*, California State Commission of Horticulture, as follows:—

All available evidence proves that the navel orange of Bahia originated about 1820 as a bud sport from the *selecta* variety, and was first propagated by a Portuguese, the first man to use this method of plant propagation in Brazil.

The Washington navel orange was introduced into the United States by the United States Department of Agriculture in 1870 from Bahia, Brazil. The first trees sent to California by the department were planted on the L. C. Tibbets ranch at Riverside about 1875, and these two trees are still living, the property of the city.

The navel orange groves of trees of our west and of several foreign countries are directly descended from the Tibbets trees. The great commercial success of the navel orange industry in California is the foundation upon which the successful citrus industry of this State as a whole has been built.

The oldest navel orange trees found in Brazil were more than forty years of age. They are now producing the largest and best crops of any trees found in that district.

The method of tree renewal for treating diseased trees in Bahia is a success. The replacing of diseased trees by growing a new top is universally practised in that region.

The use of manure in maintaining the citrus trees in productive condition, and improving the quality of the fruit is an established and successful practice. The liberal use of manure is considered to be absolutely essential to profitable citrus production. The average annual production is about 100 navel oranges per tree.

Scale and other insect enemies of the citrus are evidently controlled by natural parasites.

The Bahian navel fruits are very different in appearance, quality, and other commercial characteristics from Californian fruit. For this reason we may safely conclude that no one can foretell exactly the behaviour of plants under new environmental conditions. Consequently all food-plants introduced should have a wide and careful trial, and in our opinion all foreign food-plants should be tried without too fixed ideas as to their probable behaviour in any particular region.

The shipment of bud wood or trees from Brazil is attended with both difficulty and danger. Great care must be used in packing and condition of storage and shipment in order to preserve the buds in living condition. The bud wood should be inspected with the greatest possible care in Brazil and in the United States in order to prevent the introduction of insect enemies, fungous disease or other parasitic pests.

The discovery of the Bahia navel orange by a traveller in Brazil is a good illustration of the importance of careful observation of food-plants in foreign countries by all travellers. All information about new food-plants found in this way is likely to prove of value. Through the Office of Seed and Plant Introduction of the United States Department of Agriculture, such information can be followed up, and if desirable, supplies of bud wood or seed be obtained for trial in this country.

We found a total of about 76,000 navel orange trees near Bahia. The orchards are located on hilltops or hillsides. The orange growers are prosperous and an effort is being made by the local government to extend the culture of this variety.

A permanent cover crop of Para grass in connexion with the liberal use of cow manure was the most successful method of culture observed, under the conditions of an average annual rainfall of about 50 inches.

Citrus bud sports are common in the orchards observed. The origin of the navel orange from this cause is proof of the importance of this condition in the improvement of citrus fruits.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST

ST. VINCENT. In his report for the month of December Mr. W. N. Sands states that in the Experiment Stations routine work was carried on in connexion with the gathering and examination of seed-cotton from selected and hybrid plants, and the collection and destruction of cotton stainers. Plant distribution included 3 grafted mango plants and 27 miscellaneous. Work in the Botanic Gardens and nursery consisted of the cutlassing of rubber and cacao plots, trimming trees, and cleaning walks and plants. In addition, seventy young cacao plants were budded at stake in plots and 'thrips' fungus from culture prepared by the Mycologist of the Imperial Department was sprayed on cacao. In regard to staple crops, it is stated that preparations were being made to start sugar-making, and improvements in machinery for the manufacture of a good grade of muscovado sugar had been effected on several estates. The cane cultivations made good progress generally. The reaping of arrowroot was retarded owing to the unusually dry weather. Cotton picking was carried on under favourable conditions, but the yields generally were very poor. A further outbreak of cotton worm occurred at Ratho Mill estate, but the crop was well advanced and little damage was done. The Imperial Commissioner of Agriculture accompanied by Mr. Edgar Tripp, Secretary of the Agricultural Society, Trinidad, inspected the Government Ginney and Experiment Station with the Agricultural Superintendent on December 1. Visits of officers of the Department included one on December 8 by the Agricultural Superintendent and Assistant Agricultural Superintendent to Young's Island, to ascertain if there was land there suitable for an isolation plot for the propagation of a pure strain of Sea Island cotton for general planting. The situation was considered satisfactory, and a scheme will be submitted. An investigation to endeavour to ascertain where the eggs of cotton stainer are laid was started by the Agricultural Superintendent.

The weather during the month was abnormally dry. The rainfall at the Botanic Station was 2.29 inches, and at the Experiment Station 2.07 inches. The total precipitation for the year 1916 at these stations was 137.63 and 119.75 inches, respectively.

DOMINICA. Mr. Joseph Jones reports a continuation of general routine work in the Experiment Stations during the month of December. Nine bags of cacao and one of kola nuts were shipped to London during the month. Plant distribution was as follows: limes 4,800, budded citrus 118, shade trees 80, miscellaneous 3, making a total of 4,971. In regard to staple crops he states that a fair second crop of limes is now being reaped by many of the estates that did

raw lime juice is now 1s. per gallon locally. His Honour the Administrator has appointed a small committee to report on the question of erecting a lime factory at Grandbay: the committee paid a visit to the district on December 27. Thirty-one samples of lime juice were analysed in the chemical laboratory during the month. In addition, the data for constructing a table showing (a) hydrometer reading, (b) citrometer reading, and (c) acid test of boiling juice at different concentrations, were obtained. A physical analysis of the soils of the lime experiment station was completed.

The rainfall for the month was 3.77 inches. The total rainfall for 1916 was 84.42 inches, which is 6.45 inches more than the mean of the last twenty-three years.

MONTSERRAT. The Curator (Mr. W. Robson) in his notes for the month of December mentions, in addition to planting operations in the experiment stations, that three distillations of bay leaves, making a total of forty-one for the year, were made. The yield of leaves from the plot for the year has exceeded 6,000 lb., equal to 64 lb. of oil. Five types of papaw are being cultivated in the endeavour to obtain a good bleeding variety for the preparation of papain. Referring to staple crops, Mr. Robson states that on many of the estates the destruction of old cotton plants is being pushed forward, and the land is being prepared for next crop. Except in a few isolated localities, the picking of cotton has been practically completed. Most estates have made fair crops, the most deterrent climatic factor having been the wet month of October. Otherwise the season has been favourable. In regard to the preparation of corn meal, one estate has found a cotton seed disintegrator to be very effective in its preparation. The re-erection of machinery for the manufacture of muscovado sugar is in contemplation at Brodricks, Roches, Olveston, Brades and Trants, with extensions at a few other places. There was nothing in particular to record in connexion with the lime industry. Cotton stainers were numerous in all districts at the end of the month, and in this connexion, the compulsory destruction of all the Mahoe trees in the island has been suggested to the Government. Eleven samples of cotton lint and seed-cotton of the current crop were sent to the Imperial Institute for addition to the collection. Several visits were made to Harris's Station in connexion with its being closed at the end of December. The necessary additions were made to the onion building. The date fixed by law for the destruction of old cotton plants is January 31, and planting will be allowed as from March 1, 1917.

The rainfall for the month was—Grove Station 4.48 inches, Harris's Station 3.82 inches.

ANTIGUA. According to Mr. T. Jackson's report, plant distribution in the month of December included 426 sisal, 226 coco-nuts, 100 limes, 94 Prosopis, 9 miscellaneous, 75,100 cane plants, 76,800 sweet potato cuttings, 7,200 cassava cuttings, and 29 plots vegetable seeds. In his observations relating to staple crops, the Agricultural Superintendent states that at the present time the cane crop requires rain. Cultivation of land for next year's crop is progressing rapidly on account of favourable weather for these operations. The onion crop is not sufficiently far advanced to withstand a long spell of drought, and rain for this crop is badly required. The area under cotton for the year 1915-16 in Antigua is 280 acres, in Barbuda 100 acres. Severe attacks of caterpillars on onions, and slight attacks of cotton caterpillars were experienced.

The rainfall for the month was 1.92 inches, for the year 65.05 inches. From an agricultural point of view the past year has been an exceptionally good one.

ST. KITTS. Mr. F. R. Shepherd in his report for the month of December, states that plant distribution comprised 7,420 cane cuttings to estates with experiment plots, and 50 ornamental cuttings and 2 bags of seed and roots of *Saccharum ciliare* sent to Montserrat. Referring to staple crops, the Agricultural Superintendent states that the old cane crop is rapidly ripening up with a large number of arrows than is usually seen. Reaping of fields on muscovado estates, left over from last season, is in progress. The young cane crop is growing well, and much attention is paid to the selection of cuttings from the best varieties. All old cotton on estates is being rapidly cleared off the land and very little picking remains to be done. Prices paid locally are from 2s. 4½d. to 2s. 5d. per lb. lint. The average return per acre of lint will be considerably lower than in past years owing to the unfavourable season. Leaf-blister mite is making its appearance, but too late to do any harm to the crop. Work in the Government laboratory included analyses of ten samples of milk from the Inspector of Police, complete analysis of Basseterre town water-supply, estimation of available phosphoric acid and potash in two samples of soil, and examination of forty samples of cotton.

The rainfall for the month was 2.47 inches, for the year 65.94 inches.

BATS IN BUILDINGS.

During April 1916, an enquiry was received at this Office from the Rev. W. Saywell, St. Kitts, as to the best methods of getting rid of bats and bees that were infesting the Wesleyan Church at Basseterre, in that part of the building between the ceiling and the roof. The existence of the bats was disclosed by the removal of the ceiling, rendered necessary on account of the need for repair. In reply to the enquiry several suggestions were put forward. The first method suggested was to prevent the return of the bats into the building after they had flown out at night to feed. It was suggested that arrangements should be made for closing all doors, windows, cracks, etc., during the time between the exodus of the animals, and their return. For this purpose strong mesh wire was regarded as being suitable for closing the openings. The next suggestion was that the whole interior of the roof should be white-washed with a wash of white lime containing crude carbolic acid at the rate of 1 pint of carbolic to every 4 gallons of wash. This would have two principal effects: one would be to disinfect and do away with the smell complained of, and the other would be to make the roof light and unattractive for the bats, while at the same time any fugitive bats would be easily seen against the white background.

At a last resort it was suggested that the church might be fumigated by means of burning sulphur. The building, it was pointed out, would have to be closed as tightly as possible, and fumigation would have to be carried on for twenty-four hours. It would also be necessary to remove from the building all metal ornaments.

Last month a letter was received from the Rev. Saywell, to the effect that the adoption of some of the foregoing methods had proved satisfactory, and that he had succeeded in driving the animals from the building. The principal method was the employment of burning sulphur. The ventilators were covered with wire mesh after the disinfection, thus admitting plenty of air but obstructing the re-entrance of bats. It may be added that before disinfection, the beams and rafters were covered with solignum.

To show the extent of this infestation of bats, it may be mentioned that when the ceiling was first removed, there was an accumulation of bat manure to the extent of 4 cart loads.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ending December 23, 1916, is as follows:—

ISLANDS. The market was quiet throughout the week, with sales of only 30 bales Fine Islands at our previous quotation of $53\frac{1}{2}$ c. landed. With factors holding only small stocks, and expecting moderate receipts from now on, they are unwilling sellers at any decline. As the Bureau reports the amount ginned to the 13th instant as only 2,325 bales, they fear the crop may not much exceed 3,000 bales.

In the absence of demand we can only repeat our previous quotations, viz:

Fine $52\text{c.} = 53\frac{1}{2}\text{c.}$ landed.
Extra Fine $55\text{c.} = 56\frac{1}{2}\text{c.}$ „

There have been no further sales of Planters' crop lots.

GEORGIAS AND FLORIDAS. The market remained very quiet throughout the week, sales reported as only 75 bales. The offerings are small, and Factors are unwilling sellers at any much concession in price. The interior markets are reported easier, but holders will not consent to sell at much decline. With orders in hand, however, we may occasionally buy at quotations, viz:

Extra Choice and Fancy $51\text{c.} = 52\frac{1}{2}$ landed.
Choice $50\text{c.} = 51\frac{1}{2}\text{c.}$ „

The exports from Savannah for the week have been: to Liverpool 24 bales, Northern Mills 53 bales, Southern Mills 100 bales, and from Jacksonville to Northern Mills 625 bales.

The United States Census Bureau reports the amount of cotton ginned to December 13, as follows:—

South Carolina	2,325 bales	} making a total of 110,448 bales.
Georgia	73,395 „	
Florida	34,728 „	
Against last year	83,810 „	Total crop
„ 1914	71,488 „	85,278 „
„ 1913	69,312 „	78,857 „
„ 1912	58,804 „	85,544 „
		66,169 „

Factors in Savannah think there is an error of 10,000 bales in the Florida report—that Stapled Uplands have been counted as Sea Islands. The Census Bureau reports all cotton ginned in Florida up to December 13 as 49,343 bales, of which 34,728 bales are Sea Islands, leaving for Uplands only 14,615 bales, which is too small for the State; the same time last year Uplands were reported as 26,661 bales. It is therefore possible this report may be corrected later on.

PROGRESS IN THE MINOR INDUSTRIES OF ST. VINCENT.

The following notes on the minor crops of St. Vincent appear in the Report of the Agricultural Department, for 1915-16:—

INDIAN CORN.

Owing to (a) the high prices of flour and oats, (b) the remunerative prices of Indian corn in the intercolonial markets, and (c) the facilities offered by the Government Cotton Ginnery for the purchase of corn on a profit-sharing basis and the kiln-drying of it for shipment, increased attention was given to this crop.

It was difficult to obtain figures of actual production as a large proportion of the crop was used as food for man and beast, for the reasons mentioned above in (a). The actual

exports of Indian corn in 1915 amounted to 1,518 bushels, but a far larger export is to be looked for in 1916.

The corn-drying machinery installed at the Government Ginnery consisted of a No. 1 Ideal Hess Corn Drier with a capacity of 400 to 500 bushels in ten hours, and a Little Victor Sheller and Cleaner, together with the necessary accessories. The machinery was driven off the main driving shaft of the Ginnery, and the steam for the coils of the drier was obtained from the boiler of the steam engine.

Two small mills for grinding corn were also erected to allow those small growers who desired to convert their corn into a meal for domestic use to do so at a charge of $\frac{1}{2}$ d. per gallon of meal. It is proposed to obtain a large power grinding mill to afford further facilities to growers in this direction.

As was noted in the last issue of the *Agricultural News*, a considerable amount of work was undertaken by the Officers of the Department in the endeavour to breed good varieties; to ascertain the best methods of planting and the control of pests; and also to bring the results of the experiments to the notice of planters throughout the Colony.

The outlook for corn cultivation now that a kiln drier is available to ensure the proper drying of the produce in adverse weather is full of promise, and it is now left to planters to make proper provision for the storage of the corn so that it may not be attacked by grain insects.

COCO-NUTS.

A further extension of the planting of coco-nuts has to be recorded. In the Carib Country alone there were under cultivation 1,100 acres. Some of the groves were coming into bearing, and it is hoped to make the first shipments of nuts or copra during the coming year. The growth and the health of the plants were good. In the Leeward District also, considerable activity was shown, and the area of the Colony's coco-nut cultivations is now estimated at between 2,000 and 3,000 acres.

GROUND NUTS.

Ground nut cultivation continued to extend. The exports of dried unshelled nuts in 1914 amounted to 5,781 bushels valued at £1,446, whereas in 1915 the exports totalled 10,386 bushels valued at £2,636. The chief market for the product was Trinidad. The best results with new varieties have been obtained at Spring estate. Here the owner, who is a large grower, found that the 'Virginia Bunch' variety gave the best all-round results. It was superior in the size of nut and bearing to the local variety, but the weight of a bushel was rather less. Prices were satisfactory throughout the year.

PEAS.

The chief peas grown for export were the pigeon pea (*Cajanus indicus*), and the black-eye pea (*Vigna catjang* var.). The area under cultivation was larger than usual. The exports of these peas together amounted in 1914 to 2,141 bushels valued at £707, and in 1915, 3,066 bushels valued at £1,017.

Small areas of the 'Bounceval pea' (*Vigna unguiculata* var.), and the white Lima bean (*Phaseolus lunatus*) were also grown. The former grew and bore particularly well under local conditions, but it had not found favour with shippers on account of its realizing a lower price per lb. in the intercolonial markets than the black-eye pea. The local white Lima bean was grown chiefly in Bequia, and the small plots there gave very fair and encouraging returns, but in St. Vincent, results with both native and imported varieties were poor. It is hoped, however, to breed a variety of this bean which will thrive under local conditions, and considerable progress was made in this direction at the Experiment Station.

ORGANIZATION OF LOCAL FOOD SUPPLIES.

Suggestions are put forward in the *Barbados Advocate* for January 18, concerning the need for Government action in the matter of establishing larger areas in that island under food-crops, even though it would necessitate a reduction in the area under sugar-cane. It is suggested that the returns should be calculated at the same value as if the land were in sugar-cane, the loss, if any, being made good by the Government.

In connexion with these proposals, it will perhaps interest readers to learn of the steps that have been taken in Antigua, an island that has always shown itself alive to the value of concerted action. Here a Board for Co-operative Organizations has been formed, which was recently instructed to consider steps to be taken in connexion with the probable shortage of food in the island.

Meetings of the Board were held and the following steps were taken:—

(1) A circular was addressed to all planters throughout the island with a view to obtaining information as to the quantity of foodstuffs planted in the island, also with a view to urging the necessity on agriculturists for planting food-crops, and obtaining promises in this connexion. The circular was sent to sixty-seven estates, and from these fifty-five replies have been received. The position was found to be by no means reassuring. The actual total area returned as planted in provision crops in Antigua was 300 acres, while the areas immediately in prospect for planting amounted to 394 acres. On every hand complaints were received from estate managers of labour difficulties which greatly interfere with the planting of provisions. Mention may be made of the offer of one cane planter to provide 10 acres of land on his estate which would be placed at the disposal of the Board or the Government for the purpose of renting to peasants to grow provisions thereon. Several other planters have offered to rent land to peasants with the same object, but with little or no response.

(2) The second line of action was to appoint sub-committees in the different parishes. The duty of these was to keep the Central Committee informed of the position in relation to the supply of foodstuffs in the different parishes, and to urge upon the people the necessity for increasing the amount of provisions at present grown, and to suggest plans of action.

The Central Board has made recommendations to the Government that they should ascertain and keep themselves systematically informed on the following points in future:—

- (1) The quantity of foodstuffs stocked by merchants.
- (2) The prospect of obtaining future supplies, and the amount of orders placed.

The Committee have further strongly recommended that a store of corn, preferably locally grown, should be obtained without delay, kiln-dried and stored at the Government Granary with the object of making corn meal, as and when required.

Experiments have been conducted in connexion with the preparation of sweet potato meal and the baking of bread with this and with corn meal. So soon as definite information is available, it is proposed to consider the feasibility of recommending that the Government should enforce the baking of a diluted bread (i.e. diluted with corn meal or sweet potato meal).

Finally the Committee have recommended to the Government that it is desirable to give consideration to the

question of standardizing the weights of loaves of bread, and that information should be published concerning the relative feeding value of the various food-crops. The Committee have recommended that the attention of the Government should be drawn to the need for the application of the most stringent measures to check praedial larceny.

From what has been stated above it will be seen that the Agricultural and Commercial Society of Antigua has been making active efforts to improve the local situation as regards food supplies, and is in a position to furnish the Government with information and support, should compulsory measures become necessary.

RECENT SPREAD OF THE COTTON BOLL WEEVIL.

A brief history of the movement of this pest through the United States suggests, from a study of specimens collected in all parts of the infested regions of North America, that there are three lines of dispersion. It seems probable that the boll weevil originated in Guatemala or some other portion of Central America, and that the most typical strain migrated northward through the mountains of Mexico into Arizona, where it is now found as a native species on the wild cotton-like plant *Thurberia thespesoides*. The main migration was along the Gulf Coast through the cultivated cotton regions into the United States. The third line of dispersion was through Yucatan across the Gulf, to Cuba. Specimens collected at the three termini of these dispersions appear to be very distinct varieties. That variety which is found on cultivated cotton in the United States is the smallest found and the most variable. The movement of the weevil is controlled by the amount of food supply, which regulates the time and distance of natural movement by winds and floods, and by artificial agencies.

The most interesting development of the present year is the extension of the weevil to the northern limits of cotton growth in Oklahoma and Arkansas into Central Tennessee; eastward to the Atlantic Ocean south of Savannah; and the infestation of practically all the cotton region of Florida. The only Sea Island cotton section now not infested is that of South Carolina. (*Science*, December 22, 1916.)

Nature of Light Production in Animals.—

The following has reference to the nature of the light production in certain luminous animals. It is taken from an article in *Science* (November 3).

'If Dubois's statement that Pholas luciferin will give light with oxidizing agents, that it is not destroyed by heat and is found only in luminous cells, be confirmed, we may perhaps look to two general methods of light production in the animal Kingdom—one as in Pholas, the oxidation with light production of luciferin by luciferase so closely paralleled by pyrogallol and peroxidases; the other as in Cypridina and the fire-fly, through the interaction of photogenin and photophelein, the photogenin giving light by some mechanism which can not at present be definitely stated. The closest parallel is the zymase system. Just as zymase is inactive without its co-enzyme so photogenin is inactive (will not emit light) without photophelein. Just as there are certain quantitative relations between zymase and co-enzyme, so there are similar quantitative relations between photogenin and photophelein. As oxygen is necessary for light production, we may, perhaps, provisionally regard photogenin as a substance auto-oxidizable with light production only in the presence of photophelein.'

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Francis Watts, C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue deals with the subject of green manuring, and describes recent investigations conducted in India.

An article of present interest dealing with the organization of local food supplies will be found on page 23.

Insect Notes, which will be found on page 26, comprise a comprehensive account of cacao thrips, their significance, and their control.

Under Plant Diseases, on page 30, appears an article on the control of bud-rot disease in coco-nuts.

The Food Supply Question in British Guiana.

The merchants of Water Street have sent a letter to the Hon. Nelson Cannon, the senior member for Georgetown, of the Court of Policy, on the subject of the high prices of food. The letter, which has been forwarded by the Government, is published in the *Demerara Daily Chronicle* (Mail Edition) for December 8, 1916.

It calls attention principally to the need for restricting the export of rice. It refers to the possibility of a flour famine, and to the present high prices of food-stuffs in general. In connexion with this movement it is stated in a more recent paper from Demerara, that a special foodstuffs committee has been formed, which includes Professor Harrison, Director of Science and Agriculture. The first object of the committee is to find substitutes for flour.

Root Systems of Plants in Reference to Selection and Drought Resistance.

In a previous issue of the *Agricultural News* (Vol. XV, No. 381, p. 394), reference was made to experiments which had been conducted in the United States, to determine the fundamental characteristics of sorghum plants (Guinea corn, for example), that enable them to withstand severe climatic conditions better than Indian corn (maize). In the *International Review of the Science and Practice of Agriculture*, for July 1916, are described experiments on differences in the dimensions of the root system in different types of cultivated plants.

Remarkably little study having been devoted to the underground portions of plants as compared with the parts above ground, the writer of the article referred to undertook a series of methodical investigations of the root systems of herbaceous plants, cultivated and wild, in the laboratories and experimental Stations of the Agronomic Institute of Moscow, with the assistance of the Department of Agriculture. The starting point in these enquires was the fact that there is a relation between the depth to which plants extend their roots and their resistance to drought. Assuming, therefore, within the limitations of a given species, the plants most resistant to drought are those which possess, among other things, a root system carried to a greater depth, stress is laid on the need for the following: (1) Statistical investigations of the depth reached by the roots of all plants, cultivated and wild, of interest to agriculture; (2) investigations into the 'metric differences' (i.e. in length and weight) of the root systems of the different species and varieties of cultivated plants; (3) investigations into the fixation and the increase by selection of the power of deep root growth. Upon these lines investigations were undertaken of the root systems of oats, wheat, flax, and peas. The seeds were taken exclusively from the *pure lines* obtained at the selection Station of the Agronomic Institute of Moscow, because the preliminary studies carried out with commercial oat seeds had given very divergent results as regards downward growth of the root system. The tests show that there is a synchronal constancy in

the downward growth of the root system in individuals of the same pure lines.

The enquiries of the writer into the length and weight of the root systems of oats, wheat and flax establish a *clear and essential difference between the length (and weight) in different forms of oats, spring wheat, and flax*. An interesting fact noted on comparing the root-lengths with the time of ripening, is, that the longer the roots, the greater the time required for ripening. In other words, the length of the roots is proportional to the length of life of the plant.

Relation of Green Manures to the Failure of Certain Seedlings.

The editorial in the present issue of this Journal discusses the subject of green manuring, with special reference to the practice in the West Indies, and the problems yet remaining to be solved in regard to the question generally. In this connexion it should be of value to note a reference made to the results of experiments conducted with the object of determining the relation of green manures to the failure of certain seedlings, which appear in the *International Review of the Science and Practice of Agriculture*, for July 1916, and which are complementary to the points brought out in our editorial.

It had been shown in a previous report that if green manures are turned under and cotton planted immediately, a decrease in germination may result, while if the operation is repeated three weeks later, germination is perfectly normal.

With a view to studying this phenomenon, fresh experiments were made in jars and in the field, and the investigations as a whole confirmed the injurious action of green manure on seed germination. It appears to be due to some parasitic fungus (*Rhizoctonia* sp.). During the first period of decomposition of the green manure, many fungi develop, some of them having a destructive action on germs. Oil seeds in particular are very liable to be injured. Starchy seeds, on the contrary, are highly resistant. Cotton and soya seeds are extremely sensitive to green manure. The germination of flax, pea-nuts, hemp, mustard, and clover is likewise reduced, though to a less extent, by the presence of decomposing vegetable tissue. The germination of buckwheat, corn, oats, and wheat is not affected by green manure.

The injurious action of green manure on oil seeds is confined mostly to the first stages of decomposition. The experiments undertaken appeared to show that two weeks after the green manure has been turned in, it no longer has any serious harmful effect on the germination of oil seed. The addition of small quantities of lime appears to increase the injury to germination, the greater or less rapidity of the latter to some extent influencing the amount of such injury. Thus, slow germination is marked by a high percentage of diseased seedlings.

The foregoing findings present information which cannot fail to be of interest and value to those who have been engaged in green-dressing trials in the West Indies, and should prove an incentive to further experimentation.

Adulteration of Milk in the Leeward Islands.

In Antigua, in spite of a large amount of persistent effort that has been devoted to the problem of putting a stop to the adulteration of milk, there seems to be very little improvement effected, according to a memorandum prepared by Dr. H. A. Tempany, Superintendent of Agriculture for the Leeward Islands. It appears that in Antigua, the legislation is inadequate to enable prosecutions to be taken by the police in a systematic manner, based upon the evidence of analysis at the Government Laboratory. In St. Kitts, on the other hand, the requisite legislation has been passed which has resulted in a complete change in the situation.

In St. Kitts during 1913, 84 per cent. of the samples analysed were found to be adulterated with water. The introduction of legislation brought about such a complete change that in 1916, no samples were found to contain any added water whatsoever. In 1897, in Antigua, 63 per cent. of the samples analysed were adulterated. In 1912-13, 83 per cent. were adulterated. In 1916 there was a reduction to 53 per cent., but that does not make the situation satisfactory. In Montserrat during 1916, 59 per cent. of the samples analysed were found to be adulterated. The St. Kitts experience clearly shows that the sale of genuine milk can be easily secured by a proper co-operation between the police and the chemical authorities, and it is somewhat surprising that this should be arranged for in one island of a Colony and not in another.

Seed Tape.

Several trials have been made locally with seed tape, the newly invented method for planting seed. The tape consists of paper treated chemically, and the seeds are enclosed and placed more or less equally distant from each other. In planting the tape in the soil, it is necessary to water very thoroughly.

Many advantages are claimed for this method of seed planting, the chief of which is the fact that the whole tape being planted, and the seeds correctly spaced in the tape, it eliminates the thinning out and transplanting process. It is understood that the tape is highly fertilized, which should stimulate the growth of the seedlings; and it is claimed that the seed, being enclosed, should be to a certain extent protected against destruction by ants during the period of germination.

Each seed is guaranteed to grow, and certainly it must be admitted from the trials that have been made locally, that the germination is very satisfactory indeed. It is likely that seed tape will become more and more adopted for garden work, and it seems especially well adapted to tropical conditions, particularly on account of the fact that the seeds are protected from ants which constitute such a troublesome pest. Moreover, planting seed by the tape method involves a minimum of labour and trouble.

INSECT NOTES.

THE CACAO THRIPS.

This insect has over a period of several years been the subject of articles by Maxwell-Lefroy, Elot, Ballou, Urich, Russell and others, to whom the writer is indebted for most of the information contained in this brief popular article. Observations were also made by the writer during a recent short visit to Grenada.

ORIGIN AND DISTRIBUTION.

The cacao thrips was first given a definite scientific name from material collected in Guadeloupe about sixteen years ago, but it has doubtless always been present on cacao in the West Indies. It is now known to have a wide distribution, having been recorded from Grenada, Guadeloupe, St. Vincent, St. Lucia, Dominica, Trinidad, Tobago, the Virgin Islands, Surinam, Uganda and Honolulu, and Hawaii (in greenhouses). It also occurs on a strip of the east coast of Florida, where it is known as the red-banded thrips, and has been reported from Ceylon by Maxwell-Lefroy.

FOOD-PLANTS.

This thrips is best known in the West Indies by reason of its injury to the leaves and pods of cacao, and under conditions favourable to its development it is capable of doing considerable damage to this crop. It is also found on several other plants, including cashew, guava, Indian almond (*Terminalia catappa*), mango, Liberian coffee, roses, kola, and avocado pear.

DESCRIPTION.

The adult cacao thrips (*Heliothrips rubrocinctus* Giard) is dark brown, or black, the female being about $\frac{1}{25}$ -inch long, while the male is much smaller and is rarely seen. The recently emerged adults are light in colour but soon become darker.

The eggs as dissected out of the female by Urich, are minute, kidney-shaped, and quite transparent. They are inserted by the female into the leaf and pod tissues of the cacao, according to Urich. It is recorded by Russell that the female of this same thrips deposits the eggs in the young leaves of the mango. He says 'that after the female has deposited each egg she seals the opening with a large drop of excrement which dries to a flat scale so that the egg pocket is concealed.' The other immature stages consisting of larvae and nymphs are pale yellow to yellowish green, with a bright red band across the abdomen.

HABITS AND INJURY.

The adults are usually found on the underside of the younger leaves and on the pods, where they go to feed and lay their eggs. They can sometimes be seen crawling about with the abdomen elevated, and when disturbed, crawl rapidly about or jump away quickly. Urich has observed them flying in the cool of the afternoon in Trinidad.

The larvae are found mostly on the half-grown and older leaves, and on the pods, and together with the adults may cause such severe injury to the leaves by sucking the juices that they sometimes dry up and fall off. In a severe attack trees may suffer two or three defoliations while the thrips are abundant. The younger stages are always seen with the abdomen in the air, bearing at its tip a small drop of excrement, which from time to time falls to the leaf or pod and dries to a thin brown flake.

The injury to the pods causes a brown corky scab to form, and in a severe infestation, the pods have a russett appearance, which makes it difficult for the cacao picker to tell when they are ripe. The pods themselves appear to be very slightly injured by thrips, and the only appreciable loss seems to result from immature discoloured pods being picked for ripe ones by inexperienced pickers.

SIGNIFICANCE OF THRIPS.

In places like Grenada, where the cacao thrips is an important insect, it has been noticed that its outbreaks are generally confined year after year to areas where the trees are in an abnormal condition. Occasionally when conditions are exceptionally favourable to the insect or unfavourable to the trees, there comes an unusually severe attack of this pest. At such times the regular thrips areas may be temporarily enlarged, or the insect may attract attention in places where it has hitherto passed unnoticed.

It has also been observed that where cacao trees are kept in a normal healthy state, where the soil conditions are suitable, where good cultural methods, such as efficient drainage, periodical manuring or mulching, forking or superficial hoeing, etc., are systematically and persistently carried on, where root disease is not prevalent—in such places as these thrips is a negligible quantity, and never seems to become a pest, though sometimes present. Urich has noticed in Trinidad that thrips, although present in shaded cacao, is more abundant in unshaded or lightly shaded areas of estates. So far as thrips is concerned, shade is beneficial to cacao under certain conditions.

Thrips is only one of several troubles which attack the cacao tree, but like many other enemies, plant or insect, it does not seem to make progress on normal, healthy trees, although it may be present in small numbers. As soon as the trees show the least signs of weakening, these numerous plant and insect enemies gradually get a hold and may even attract some attention in slightly abnormal seasons, but not enough to warrant special measures being taken against them. Then comes a year in which the climatic conditions may be unusually favourable to one or more of the many enemies. There is a sudden combined onslaught, and we get what is known as a 'thrips year', thrips being the pest most in evidence. When an attack of this kind comes along, the cacao growers may be caught unprepared, and spasmodic methods of an emergency nature are adopted, and these, as a rule, only serve to hasten the departure of the already disappearing thrips. The trees make a rapid partial recovery, and the growers are lulled into a false security through a succession of good years. The thrips and other enemies are, however, still causing a little trouble here and there in the same old places, but the temporarily improved health of the trees, coupled perhaps with climatic conditions unfavourable to thrips, serve to keep this insect more or less in abeyance, and the cacao planters are no longer reminded of the other causes, which are all the time contributing to the gradually weakening of the trees. Then comes another thrips year and we get the same story over again.

CONTROL METHODS.

Now it will be seen from the above remarks, that thrips is one of those insects which are unable to make any progress on strong vigorous trees; but let the same trees get run down or weakened, and it is certain that thrips will find them out sooner or later, will single them out for marked attention, and will continue to do so year after year until they are restored to their normal vigour by ordinary cultural methods, such as draining, forking, manuring, mulching, etc. These methods, to be effective, must be systematically and steadily

applied, and must of course be adapted to the particular soil conditions. As a general rule, good cultivation and hygienic orchard management ought to be sufficient to keep thrips and other insect and plant enemies in check; but if planters feel that something else is needed to control thrips while these measures are being put into practice, then spraying with a contact insecticide can be recommended.

Experiments have been made in Trinidad with contact insecticides for thrips, and at present nicotine sulphate, or Black Leaf 40, as it is called commercially, seems to be the remedy most favourably thought of. It is generally used at the rate of 1 in 1,200 to 1,400 or 1,600. Other insecticides, such as kerosene emulsion or rosin wash have also been used against thrips with good results, but Black Leaf 40* is more easily kept in stock, and more readily prepared for immediate use.

In most countries where thrips has occurred year after year in the same areas, it is doubtless known by this time approximately when and where the attack will begin. The planter should therefore have everything ready to spray just when the thrips first appears so as to check it before it spreads too far; at this stage the area to be sprayed would only be comparatively small, and effective control may result.

Observations made throughout the dry season would doubtless show to what extent these insects are to be found on their alternative food-plants—cashew, almond, mango, guava, etc.; also how far they remain on the cacao during this period. If it is found that these plants really form a menace to the cacao by harbouring thrips during the dry season they ought to be eradicated. Failing their destruction, they should be sprayed with Black Leaf 40, or kerosene emulsion.

NATURAL ENEMIES.

A fungus was recently observed on the cacao thrips by Mr. J. C. Moore, and pointed out to the writer during a visit to Grenada. Specimens of this were submitted to Mr. W. Nowell, Mycologist of the Imperial Department, who says that this fungus is identical with that recently found attacking thrips in St. Vincent. Cultures of this fungus have been sent to Mr. Moore to be used experimentally against the cacao thrips. An account of this fungus appeared in the *Agricultural News* for December 30, 1916.

It is not advised, however, that too much reliance should be placed on the employment of this fungus.

A predaceous thrips was found fairly well distributed in Grenada, but only in small numbers. This insect is larger than the cacao thrips, and is shiny black with a straw-coloured band across the middle of the body. It is usually to be seen crawling busily over the leaves as if in search of food, but was never observed attacking the cacao thrips.

SUMMARY.

By way of summary, it may be stated that the recommendations made to cacao planters in order to control thrips are: first to take every reasonable precaution to ensure the health and vigour of the trees by sound cultural methods, coupled with careful regard to the general sanitation of the cacao orchards; and secondly, to endeavour to control threatened outbreaks by spraying when thrips is first observed in inappreciable numbers on the trees.

J.C.H.

*Another nicotine preparation is manufactured by William Cooper and Nephews, Berkhamsted, England. This is known as V 2 Summer Fluid.



CO-OPERATIVE AGRICULTURAL SOCIETIES IN GREAT BRITAIN.

The number of Registered Societies affiliated to the Agricultural Organization Society of England on December 31, 1916, was as follows.—

Farmers' Co-operative Societies:—

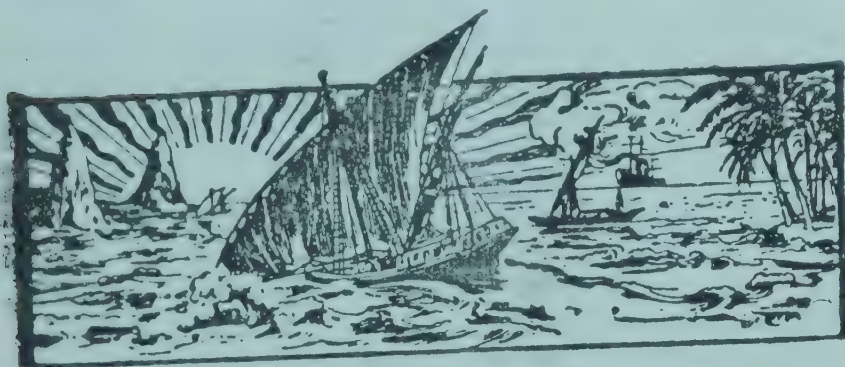
Purchase of Agricultural Requirements	213
Dairy	38
Eggs and Poultry	29
Co-operative Auctions, Fruit Societies, etc.	27
Total	307
Land-renting Societies (Small Holdings and Allotments)	177
Credit Societies	48
Agricultural and General Co-operative Insurance Society	1
Farmers' Central Trading Board	1
Miscellaneous Associations	16

Total No. of Registered Societies 550

These figures do not include a considerable number of depôts under the management of societies.

The societies in the other groups differ so much in their scope and objects that it is better to consider them separately under the special sections of this report devoted to their work. Many individual societies have branch depôts. In addition, by the end of the year, eleven Women's Institutes had been formed.

There seems to be an impression prevalent in some quarters that the Agricultural Co-operative movement in England and Wales is practically confined to the purchase of feeding stuffs, fertilizers and other agricultural requirements, and that but little has been done in connexion with the disposal of farm produce. For instance, in the report of the Departmental Committee to consider the Settlement of Sailors and Soldiers on the Land, the following passage occurs: 'The Agricultural Organization Society has endeavoured to deal with the question by the promotion of Agricultural Co-operative Trading Societies, but though some of these societies have developed a considerable trade in the co-operative purchase of requirements, there are very few cases in which societies have been successful in organizing the co-operative sale of produce.' In the statistics which appear at the end of the report, it will be seen that the trade done by Dairy Societies, Egg-Collecting Societies, Auctions, Fruit Growers' Societies, etc., is very considerable. But this does not nearly represent the value of the farm produce which is sold co-operatively. Many of the societies which were formed originally for the purchase of agricultural requirements, and are put in that group, deal with one or more classes of farm produce. It is most difficult, however, to obtain accurate figures to show the actual amount, owing to the way the annual returns of many societies are drawn up and the fact that their sales of all kinds are simply entered as one total. Furthermore, societies buy outright from their farmer members very considerable quantities of corn which are absorbed into their general stocks, and do not appear separately in the accounts.



GLEANINGS.

A notice appears in the *Port-of-Spain Gazette* of January 4, 1917, to the effect that in Trinidad a new supply of teak seeds (*Tectona grandis*) has been received from Burma, and is on sale at the Forest Office, Crown Lands Department, at 20c. per 1,000. The cost of package and carriage, if any, must be paid by the purchaser.

A list is given in the Report on the Agricultural Department, St. Vincent, for 1915-16, of the new lily pond that has been constructed in the Gardens. A list is included of the species of tropical water-lilies kindly presented for this pond by the Director of the Royal Botanic Gardens, Kew. These consist of *Victoria regia*, var. *trickeri*, and ten species or varieties of *Nymphaea*.

In the St. Vincent Botanic Gardens the interesting old tree, *Spachea perforata*, which is the only known specimen, is beginning to show signs of decay; according to the Agricultural Superintendent, it is unlikely that it will survive for many more years. Fortunately a limited number of young plants have been raised, one of which has been planted out in the gardens.

Figures are given in the Report on the Agricultural Department, St. Vincent, 1915-16, showing the recent development in that island of the sugar industry. In 1913 the total value of the exports of sugar products was only £173; in 1914 it rose to £1,838, while in 1915 the total value was £3,756. It is estimated that the crop now being reaped will yield an output more than double that of 1915.

During December in St. Vincent, preparations were being made to start sugar making, and improvements in machinery for the making of a good grade of muscovado sugar had been made on several estates. The cane cultivations made good progress generally. Arrowroot reaping was retarded owing to the unusually dry weather. Cotton picking was carried on under favourable conditions but the yields generally were very poor.

A note appears on Molybdenum ore in the *Bulletin of the Imperial Institute* for July-September 1916, that has a West Indian interest on account of the existence of deposits in Virgin Gorda. It is stated that by a certain process, good results can be obtained on ore containing not more than 0.5 per cent. of molybdenite. The deposits in Virgin Gorda are not rich in this mineral, but it might nevertheless be found profitable to work them, or at least it might be worth while to reinvestigate the nature and extent of these deposits.

An ingenious contrivance which enables one man to work a motor-tilling machine in which the driver is obliged to have his back to the tynes which cultivate the soil, is described in the *International Review of the Science and Practice of Agriculture* for May 1916. The contrivance consists of two mirrors, one of which is situated above the tynes so as to reflect a view of the ground in which they operate on to a second mirror located immediately in front of the driver. The angular arrangement of the mirrors is such as to prevent any interference to the line of sight.

The considerable amount of space that *Nature* for November 30, 1916, gives to a discussion of possible potassic fertilizers, leads one to expect that an important discovery has been made in regard to the extensive deposit of mica schist in South Island, New Zealand, containing, on an average, 3 per cent. of potash. The material is very soft, and if finely ground might prove valuable as a manure, though it contains a very low percentage of potash compared with kainit or sulphate of potash. As there appears to be unlimited quantities of this material available, the deposit may turn out to be of economic importance.

According to an article in the *India Rubber World* for December 1, there is some prospect that the United States may become a rubber-producing country if an active attempt is made to cultivate on an extensive scale the silver-coloured Guayule shrub, *Parthenium argentatum*, a member of the aster family which grows wild in many sections of the American south-west, as it does over the Central Plateau of Mexico. On the basis that the plant yields 8 per cent. of its dry weight in rubber, which is a conservative estimate, an acre would yield 4,000 lb. worth \$1,520, according to the present low market price of 38c. per lb. There is no doubt that if the project is practicable, the United States would greatly strengthen its economic position if it could establish rubber within its own territory.

Reference is made in the *Cyprus Agricultural Journal* to the practices in use for poisoning fish in Cyprus streams and rivers. It will be remembered that in the Report on the Agricultural Department, Dominica, 1914-15, Mr. Joseph Jones gave an account of the practices followed in that island. In Cyprus, a plant of which only the local names are given, but which is said to belong to the Scrophulariaceae, is collected in quantity, cut into small pieces, and thrown in the streams at various points. The milky sap which exudes poisons the fish, eels principally. Another method in use is to employ the fruit of the shrub *Styrax*. The action of this fruit on the fish, though not more drastic than the other, is of longer duration. The effect of both poisons is to act as a narcotic, though they will actually kill very young fish.

A RELATIVE SCORE METHOD OF RECORDING COMPARISONS OF PLANT CONDITIONS AND OTHER UNMEASURED CHARACTERS.

The following interesting method should be found useful in experiment station work in comparing the general effect of manuring upon individual plants, relative immunity to disease, and such like characters that cannot be actually measured or conveniently described in words. The account which we publish is taken from the *International Review of the Science and Practice of Agriculture* (Year VII, No. 2, February 1916):—

The lack of means of expressing more or less quantitatively, relations which are not strictly commensurable, results in the adoption of a method of simple comparison which, though not involving serious error in the case of a limited number, becomes very troublesome and faulty when many plants are to be considered or when non-simultaneous series are to be compared. Two methods are in vogue for avoiding these difficulties, viz.: (1) rough classification into excellent, good, fair, poor, etc.; (2) arranging the plants in order of merit and assigning numerical values according to an arbitrary scale.

Both these methods suffer from the inherent difficulty of being dependent for accuracy upon the observer retaining constantly in mind the characters and condition of all plants of the series at the same time. This is not only difficult but practically impossible when hundreds of plants have to be dealt with.

This difficulty has been overcome by the use of a method derived from that used by psychologists in the investigation of affections, and which enables the formalisation and partial quantitative expression of comparative judgment formed upon any criterion whatsoever.

The essence of the method consists in comparing the individuals of the series in pairs, recording the result of each comparison, and the subsequent summation of the comparisons of each pair of individuals. The result is therefore a record of individual comparisons of each plant with each other plant, and of the judgment formed in each case. This is reduced to quantitative terms by adding together the scores given to each plant in the course of the comparison.

The method may be illustrated as follows, in which eight plants are compared as to their general health and condition.

	2	3	4	5	6	7	8
1	1	3	4	5	6	7	8
2		3	4	5	6	7	8
3			3	5	6	7	8
4				5	6	7	8
5					5	5	8
6						a	8
7							8

Sixty-four squares are ruled on a sheet of paper, the numbers of the last seven plants being set down in the upper margin,

and the numbers of the first seven in the left-hand margin. Plant number 1 is then compared with plant number 2 as to their relative condition—all other plants in the series being neglected.

If it is judged that plant number 1 is better, a figure 1 is placed in the square corresponding to plant number 1 on the left and plant number 2 on the top. Proceeding, the comparison of plant number 1 with plant number 3 leads to a judgment that number 3 is better, and a number 3 is entered in the corresponding square. Similar comparisons of plant number 1 are made with plants numbers 4, 5, 6, 7, and 8, after which a fresh series is begun by comparing plant number 2 with each other plant. In this way a series of comparisons is made with each plant number. In case no difference is detected a letter 'a' is entered in the square thus counting as no score for either plant. Adding up the score we get the table given below.

A graph is then constructed by plotting these numbers as ordinates and the numbers of the plants as abscissae.

Small differences between individual plants can be taken into account by under-scoring or over-scoring the figures entered in each case, and giving each score a valuation ranging from 1 to 3 or 5 according to the accuracy desired.

By means of this scheme the writer has been able to obtain comparisons of such diverse things as chemical precipitates, degree of flocculation of clay suspensions, relative ruggedness of mountain ranges, thickness of stand of vegetation, adhesiveness of wall-paper to different plasters, etc.

Plant Number.	1	2	3	4	5	6	7	8
Scores.	1		1	1	1	1	1	1
			1	1	1	1	1	1
			1		1	1	1	1
					1	1	1	1
					1			1
					1			1
Totals	1	0	3	2	6	4	4	7

It should be emphasized that this method is nothing more than a system of facilitating, recording, and formalizing judgment, its accuracy depending upon the correctness of the individual judgments.

Supposed Precipitation of Reducing Sugars by Basic Acetate of Lead.—In a paper in the *Journal of Agricultural Science* for September last, William A. Davis deals with the question of the supposed precipitation of reducing sugars by basic acetate of lead. As the result of investigations he confirms the findings of Gill, and of Watts and Tempany, that reducing sugars are not thus precipitated, but that the optical rotary power of the solution is modified; the normal rotation can be restored by the addition of sufficient acetic acid to effect neutralization.

When, however, a large excess of basic acetate of lead is allowed to act upon laevulose for some considerable time, particularly if the solution be heated, laevulose is transformed probably into glucose, a substance which is nearly optically inactive, and which has a reducing power about one-half that of dextrose.

PLANT DISEASES.

THE STATUS AND TREATMENT OF COCO-NUT BUD-ROT.

Coco-nut plantations in the Lesser Antilles have hitherto been small and scattered. In response to the increased attention directed towards coco-nut products during the last few years, and the prospects of a permanent and increasing demand, a number of areas of considerable size have been or are being put under this crop.

While a great deal of necessarily slow botanical investigation is required before coco-nut cultivation can be regarded as satisfactory from the point of view of scientific agriculture, there appears to be no reason why adequate returns should not be generally achieved, provided only that the bud-rot disease can be avoided or kept in control.

It may therefore serve a useful purpose at this stage to give in a form convenient for reference, information as to the symptoms of the disease and the treatment to be applied. The receipt of pamphlets from Cuba and Jamaica containing condensed instructions on these matters enables this to be done with the benefit of the larger experience attained in these two islands.

PRESENT DISTRIBUTION.

As a preliminary it will be of interest to refer to a pamphlet by Mr. John R. Johnston, dated June 1916, dealing with the present status of the disease and affording data as to the progress of the disease in various districts during the last ten or fifteen years.

The most complete information refers to Cuba. Some time previous to 1886 the disease destroyed the hitherto flourishing coco-nut groves in Matanzas, and now in the western half of the island, which includes that province, it is almost impossible to bring coco-nut trees into bearing. They are very commonly planted for ornament and usually do well for five or six years, but almost invariably die about that age with all the symptoms of bud-rot. In the district of Baracoa, formerly a great centre for coco-nut production, the disease, which is said to have appeared as far back as 1880, has worked havoc during the last twenty years, and is reported to have reduced exports from 24 millions to 4 millions.

In Jamaica heavy losses were experienced in certain districts in the period 1891-1910. Legislation compelling the burning of diseased trees was adopted in 1911, and during the last few years losses from this disease have been small. A serious outbreak was reported to have occurred in the Cayman Islands in 1891.

There are reports of the occurrence of bud-rot in Santo Domingo and Hayti, but their authenticity has not been established. From Florida, the Bahamas, and Porto Rico the disease appears to be so far absent.

As regards Central America, there are reports from British and Spanish Honduras which seem to indicate the presence of the disease. There is no certain record of it from Panama, and the coast from Colon to Bocas del Toro was examined by Johnston with negative results.

In Trinidad the presence of bud-rot was confirmed by Johnston in 1907, but compulsory destruction of diseased trees, begun in 1909, has had the effect of reducing the disease to insignificant proportions.

In the Lesser Antilles small outbreaks have occurred in Grenada, St. Vincent, and St. Lucia, which were met by prompt treatment, and no case has been reported from any of the islands since 1913.

The disease is common in British Guiana and is reported from Surinam.

SYMPTOMS.

The following information is based on a recent circular (in Spanish) of the Cuban Comision de Sanidad Vegetal, of which Mr. J. R. Johnston is president, and a pamphlet on plant diseases by Mr. S. F. Ashby, Government Microbiologist, issued by the Jamaica Agricultural Society.

The account of the appearance of the disease given in the Cuban circular is as follows:—

The symptoms of bud-rot are the dropping of the young nuts; the withering of the bud and eventually the leaves turning yellow; the lowest leaves first turn yellow and fall, followed last by those surrounding the bud.

A new spike may grow out and then turn partially or wholly black. The disease may begin in the centre of the crown or lower down, either on one side of the crown or at the base of the leaf-stalk.

Ashby differentiates between the symptoms according to whether the disease starts outside the heart or within it. In the first case the early indications consist of one or more of the following: the dropping of young nuts followed by blackening and withering of the stalks, one or more leaves of middle age yellow and broken near the end, many expanded leaves hanging down the trunk, bud leaves yellow or withered, bud fallen over or fallen out. These symptoms are not in themselves decisive, since they may arise from causes other than bud-rot. Confirmation is to be sought in the shape of yellow sodden or dark sunken spots and patches at the base of the affected limb or fruiting stalk, or a soft stinking rot of the young leaf-stalks within the bud, or a similar rot in the top of the stem.

When the disease starts within the heart there is a wilted and drooping, or yellow and withered condition of the youngest leaves, and the heart may have fallen over or dropped out. These appearances also are to be confirmed by the finding of a soft rot on the young limbs, the leaf-stalks, or the top of the stem.

TREATMENT.

For the form in which the bud is not affected something may be done in the way of cure by firing the dry leaves hanging down, helped if necessary by the addition of a little kerosene, and in addition, or alternatively, cutting out the diseased tissue and treating the affected spots with a solution of corrosive sublimate (1 in 500).

In very early cases of the heart-rot, Ashby recommends that a mixture of equal parts of powdered lime and powdered copper sulphate be thrown into the heart, or that Bordeaux mixture should be syringed into it.

All advanced cases should be cut down, the crown cut to pieces, the diseased portions thoroughly charred through, and the rest well scorched.

W.N.

DESTRUCTION OF FOOD-PLANTS OF THE COTTON STAINER IN ST. VINCENT.

The destruction of 'John Bull' and silk-cotton trees under the Ordinance passed some months ago has been vigorously pursued, and the Agricultural Superintendent, Mr. W. N. Sands, forwards reports on what was achieved during the months of October and November 1916. During October, in Stubbs to Villa district, 125 silk-cotton trees were

cutdown; at Young Islands 672 'John Bull' trees; at Colonarie 419 'John Bull' trees; at Upper Diamond and Chapmans 138 'John Bull' trees; at Biabou 31 'John Bull' trees; at Mesopotamia 28 'John Bull' trees and 2 silk-cotton trees. This made a total to end of October of 1,288 'John Bull' trees and 127 silk-cotton trees.

A large number of seedlings of 'John Bull' trees were also taken out.

In the leeward district, some very large silk-cotton trees were met with. In the Layou Valley 54 were felled and at other places 96, together with 100 seedlings.

During November, in Fair Hall to Villa district, 34 silk-cotton trees were cut down, as also 516 'John Bull' trees, discovered along the seashore at Villa; at Reversion, Walliabou, Belleisle, L'Ance Mahaul, and Cumberland, 18 'John Bull' trees and 172 silk cotton trees were cut down.

A summary is appended of the work performed since the commencement to the end of November in all districts. The total number of 'John Bull' trees that have been cut down is 11,361, whilst silk-cotton trees numbering 913 have been destroyed also. In these totals no account is taken of some thousands of seedling trees destroyed.

The actual expenditure on this work up to November 30 amounted to £166 10s. 9d.

In connexion with this subject of the destruction of the native food-plants of the cotton stainer, the St. Vincent *Sentry* for December 8, 1916, refers to the silk-cotton which has been collected and forwarded to the West India Committee for making pillows and cushions, from Barbados. It is suggested that if silk-cotton were collected in St. Vincent, it would be unnecessary to cut down the trees. This does not appear to be a practical alternative however, for the simple reason that it would be impossible, on the score of expense, to carry out the operations of picking. Moreover, work of this nature would never be carried out effectively on account of the difficulties attendant on such work. There appears therefore to be no alternative but to destroy the trees outright.

AGRICULTURAL EXPORTS FROM TRINIDAD, 1915.

The following statement appears in *Colonial Reports*—Annual, No. 891:—

The rainfall in most of the districts of the Colony was appreciably above that for 1914, and the year, on the whole, was very favourable to plant growth.

Notwithstanding these favourable conditions the cacao crop yield was considerably below that of 1914.

The exports of cacao for 1915 amounted to 54,081,452 lb. of the value of £1,865,266 as compared with 63,447,876 lb. and £1,467,893 for 1914.

The direction of trade in cacao was as follows:—

United States of America	33,572,809 lb.
United Kingdom	11,037,881 „
France	8,108,522 „
Canada	1,149,270 „
Italy	131,756 „
British Colonies	39,204 „
Spain	22,010 „
Argentina	20,000 „

The exports to France decreased by about 10,000,000 lb., and those to the United Kingdom increased by nearly 4,000,000 lb. No shipments were made to Holland, Germany, Austria, Denmark or Belgium. Trade with the United States of America increased by over 2,000,000 lb., and from

this it is clear that the quality of Trinidad cacao is increasingly appreciated in this our principal market.

Owing mainly to higher prices, and partly to a better crop, sugar had a most prosperous year. The exports are as follows:—

	Quantity.	Value.
Sugar	50,607 tons	£1,070,423
Rum	915,589 gals.	86,114
Molasses	495,563 „	8,629
Bitters	27,742 „	27,746

Vacuum pan sugar forms the bulk of the crop, and a proportion of this goes into direct consumption as yellow crystals. Grey crystals are sold to the refineries. Only 597 tons of muscovado sugar was exported.

The direction of trade in vacuum pan sugar and molasses was as follows:—

VACUUM PAN SUGAR.

United Kingdom	44,872 tons
Canada	5,042 „
British West Indies	81 „
Venezuela	10 „

MOLASSES.

Canada	171,445 gals.
United Kingdom	101,716 „
Other Colonies	161,745 „
British West Indies	30,002 „
Holland	23,362 „
United States of America	7,293 „

The coco-nut industry has not yet quite recovered from the drought of previous years. The export of nuts was about 1,000,000 below that of 1914, but this was more than compensated for by an increase in the exports of copra of over 1,500,000 lb.

The direction of trade was as follows:—

	Nuts.	Copra.	Oil.
United States of America	12,488,724	2,735,206 lb.	3,300 gals.
United Kingdom	1,463,169	981,775	136
Canada	584,425	800	...
British West Indies	1 000	...	811
France	...	268,950	...
Other Colonies	16
Totals	14,537,318	3,986,731	4 263
Values	£60,576	£36,235	£658

The agricultural development of Tobago is steadily progressing. The total exports for the year were valued at £80,453, as compared with £60,482 for 1914. The principal increases are in cacao, which has risen from £0,844 in 1914 to £42,755 in 1915; coco-nut products from £10,659 in 1914 to £13,150 in 1915; and vegetables from £3,271 in 1914 to £8,379 in 1915.

Tropical Life Publishing Department of London has just issued an interesting pamphlet entitled, *The High Price of Sugar and How to Reduce It*, by Mr. Hamel Smith, Editor of *Tropical Life*. The gist of the pamphlet rests on the idea that unattached labour is becoming more and more scarce, whilst the area under cultivation grows larger and larger; above all the demand for tropical produce is growing so enormously that it would become necessary in the near future to produce the largest possible crops per acre by intensive cultivation and discard extensive methods as needing too many hands.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
December 14, 1916.

ARROWROOT—3d. to 4½d.
BALATA—Sheet, 3/3½ to 3/6; block, 2/5½ to 2/9½.
BEESWAX—No quotations.
CACAO—Trinidad, 70/- to 79/-; Grenada, 60/- to 64/6;
Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£40.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £17 per ton; Oranges, Jamaica, 17/- per case.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, 40/- to 52/6.
LIME JUICE—Raw, 2/9; concentrated, no quotations; Otto of limes (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—10d. to 2/-.
PIMENTO—No quotations.
RUBBER—Para, fine hard, 3s. 6½d.; fine soft, 2/2½; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., December 21, 1916.

CACAO—Caracas, 15½c. to 16¼c.; Grenada, 14¾c. to 15c.; Trinidad, 14¾c. to 15¼c.; Jamaica, 11¼c. to 11¾c.; Ordinary, 12c. to 12¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$33.00 to \$35.00; culls, \$22.00 to \$23.00.
COFFEE—Jamaica, 9½c. to 11½c. per lb.
GINGER—15c. to 18c. per lb.
GOAT SKINS—Jamaica, \$1.00 to \$1.15; Antigua and Barbados, 95c. to \$1.10; St. Thomas and St. Kitts, 90c. to \$1.00 per lb.
GRAPE FRUIT—Jamaica, \$1.25 to \$1.50.
LIMES—\$4.00 to \$4.50.
MACE—45c. to 52c. per lb.
NUTMEGS—19c. to 26c.
ORANGES—\$1.50 to \$2.00.
PIMENTO—5¾c. to 5¾c. per lb.
SUGAR—Centrifugals, 96°, 5.14c; Muscovados, 89°, 4.48c.; Molasses, 89°, 4.14c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., December 29, 1916.

CACAO—Venezuelan, \$13.00 to \$14.00; Trinidad, \$13.50 to \$13.75.
COCO-NUT OIL—\$1.05 per Imperial gallon.
COFFEE—Venezuelan, 14½c. to 15c.
COPRA—\$6.50 per 100 lb.
DHAI—No quotations.
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.50 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$7.40 to \$7.75; White, \$7.50 to \$7.75 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. JAMES A. LYNCH & Co., Ltd.
December 13, 1916; T. S. GARRAWAY & Co.,
December 27, 1916

ARROWROOT—\$5.00 per 100 lb.
CACAO—\$14.00 to \$15.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—\$1.75 to \$1.80 per 100 lb.
MANURES—Nitrate of soda, \$90; Cacao manure, no quotations; Sulphate of ammonia, \$110.00 to \$112.00 per ton.
MOLASSES—No quotations.
ONIONS—\$6.00.
PEAS, SPLIT—\$9.75 per 210 lb.; Canada, \$6.00 per 120 lb.
POTATOES—Nova Scotia, \$4.25 to \$6.00.
RICE—Ballam, \$7.58 to \$7.95; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$5.25 to \$5.50.

British Guiana.—Messrs. WIETING & RICHTER, December 30, 1916; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	\$11.00	
BALATA—Venezuela block		
Demerara sheet	\$65.00	
CACAO—Native	16c. per lb.	
CASSAVA—	84c.	
CASSAVA STARCH—	\$9.00	
COCO-NUTS—	\$20 to \$24 per M.	
COFFEE—Creole	12c. to 13c.	
Jamaica and Rio	15c. per lb.	
Liberian	11c.	
DHAL—	\$6.50 to \$8.00	
Green Dhal		
EDDOES—	96c.	
MOLASSES—Yellow	None	
ONIONS—Teneriffe		
Madeira	7c. to 8c.	
PEAS—Split	\$12.00 to \$12.50	
Marseilles		
PLANTAINS—	32c. to 60c.	
POTATOES—Nova Scotia	\$5.25 to \$5.50	
Lisbon		
POTATOES—Sweet, B'bados	\$1.92	
RICE—Ballam	\$7.00	
Creole		
TANNIAS—	\$2.88	
YAMS—White	\$2.40	
Buck		
SUGAR—Dark crystals	\$3.40 to \$4.50	
Yellow	\$5.00 to \$5.10	
White	\$7.00	
Molasses		
TIMBER—GREENHEART	48c. to 72c. per cub. foot	
Wallaba shingles	\$5.50 to \$7.50 per M.	
„ Cordwood	\$3.00 to \$4.00 per ton	

NO QUOTATIONS.



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Human Food Requirements.

AT the present moment when so much attention is being given to questions concerning food, and efforts are being made to utilize more fully the resources of every West Indian island, it will be of assistance to have an understanding of the composition of the various foods that are available, and of the function of the various constituents of food as well as of the requirements of men and women in the matter of food supply, so that there may be intelligent appreciation of the extent to which new forms of food may be utilized to supplement possible deficiencies.

It is recognized that the materials used as food fulfil two main requirements: they serve to build up and maintain the body structure, and afford the source of energy which manifests itself in body movements and in work. Physiologists have found that two main classes of food substances are essential to these processes: namely the proteins or flesh-formers, and the carbohydrates or heat producers.

Proteins are various nitrogenous substances of the nature of albumen: these substances in one form or other occur in all living bodies: they are essential constituents of animal food, their function being to supply the nitrogenous material of which flesh is built up.

It is not quite certain just how much protein is required by an ordinary man doing a moderate amount of work, but it is usually assumed that about 100 grams, or slightly less than a quarter of a pound is necessary; some observers are of opinion that the daily requirement is somewhat less than this, and there are large classes of people whose daily dietary contains considerably less than 100 grams.

There is more definite information as regards the amount of carbohydrates, or heat producers, and it is found that the extent to which these materials serve as food can be measured by the amount of heat they give off when they are burned, hence it is a common practice to express the food requirements in this respect in terms of units of heat known as Calories. It is known that a man of average weight doing a moderate amount of work requires a daily quantity of carbohydrates capable of giving about 3,000 Calories: this will be effected by about 1·6 lb. of carbohydrate. If the individual is doing hard work, he will require

more, and if he is not working he will require less. It is a common experience that work and exercise make people hungry.

The carbohydrates here referred to are such substances as starch and sugar, commonly occurring constituents of vegetables that serve as food. But there is another constituent which plays a very important part as a heat or energy-producing food, namely fat, or oil. It is found that one pound of fat, or oil, will produce as much heat or energy as two and a half pounds of sugar or starch, hence it will be recognized how valuable as food oils and fats are, and how they require to be taken in much smaller quantities than carbohydrates.

The daily diet of a working man must, therefore, contain about a quarter of a pound of protein and about 1·6 pounds of carbohydrate, part of which may be substituted by oil or fat, 6·4 ounces of oil or fat being equal to a pound of starch or sugar.

There are many other substances, existing in small quantities, that are used for food, which are necessary for the maintenance of health and vigour; for this reason it is desirable that the substances used as food should be varied in character, and this is desirable also from the fact that a varied diet is more appetising and pleasing, and so more beneficial; for pleasant taste and appearance play an important part in the digestion and assimilation of food.

While it is not very desirable to determine the dietary of a single ordinary individual on the basis of the analytical composition of the food supplied, yet, on the other hand, such information becomes of very great value when considering the food supply of communities as a whole, or of considerable bodies of individuals, such as exist in armies, schools, prisons or other institutions, where it is necessary to provide an adequate and properly balanced food supply. The question is of great interest to us at the moment in considering the range of applicability of such food supplies as are available to West Indian communities, and particularly in relation to such articles of food as are being newly considered.

At the end of this article there is given a table showing the average composition of a number of food materials commonly met with in the West Indies. It will be seen that most of the vegetables are rich in carbohydrates but contain little protein. There are, however, some forms of food that are rich in protein, and it becomes a matter for careful consideration how

far we can obtain the two forms of food material in appropriate quantities. We shall do well if we direct our efforts with this end in view.

So far as investigations have been made, it would seem that the diet of the labouring population of the West Indies, when it is obtainable in adequate quantity, is poor in protein but contains a good supply of carbohydrates and fat; this will be appreciated when it is remembered how largely starchy foods and sugar enter into the dietary, and how little meat is used. Reference to the table below will show that the foods commonly raised and consumed in these islands consist largely of carbohydrates, and contain little protein; and this is the case with many of the articles of food which it is commonly recommended should be grown at the present time as an emergency measure.

The position may be illustrated by reference to such substances as sweet potato meal or cassava meal. The analyses of these substances show that cassava meal contains about 80 to 85 per cent. of carbohydrates and 1·5 per cent. of protein, while sweet potato meal contains about 80 per cent. of carbohydrates and about 3·5 per cent. of protein.

From these figures it will be seen that the amount of carbohydrates required for the daily food of a man at moderate work may be furnished by about two pounds of either of these meals, but this quantity will convey about 0·03 pound of protein, in the case of the cassava meal, or about 0·07 pound in the case of the sweet potato meal, whereas some 0·2 to 0·25 may be regarded as necessary.

If we look in the table for foods rich in protein wherewith to balance this ration, we find such things of familiar use as salt fish and peas and beans.

Salt fish contains about 20 to 22 per cent. of protein, and practically no fat or carbohydrate. One pound of this would, therefore, supply the whole of the protein required to make up the deficiency of the meals referred to. On this reckoning, two pounds of cassava or sweet potato meal and a pound of salt fish would supply the food requirements of a working man for a day.

Amongst the vegetable foods rich in protein attention may be drawn to peas and beans: dried peas and beans, or the meal from them, contain about the same quantity of protein as salt fish, namely 20 to 22 per cent., so that dried peas or beans, or their meals, may be substituted for an equivalent amount of salt fish and

still supply the necessary food requirements, at the same time both cheapening and diversifying the diet.

As intimated above, there are found to be instances of people subsisting on smaller quantities of protein than 100 grams, or a quarter of a pound a day, so that there is some doubt as to the minimum supply of protein on which people may subsist.

There are races living largely on rice: this substance contains about 75 to 80 per cent. of carbohydrates and 6 to 8 per cent. of protein. Two pounds of rice will therefore, provide, approximately, the amount of carbohydrate required in a man's daily diet, but will only supply about 0.1 to 0.16 of protein. It will be recognized from this how wise is the practice which provides that a diet of rice shall usually be supplemented by salt fish, or peas or beans.

The position occupied by corn and corn meal may have brief consideration. This substance varies considerably, but we may consider the case of meal of fair average composition containing 8 per cent. of protein and 72 per cent. of carbohydrates and 3 per cent. of oil, or fat. Two pounds of meal of this composition will supply about the equivalent of 1.6 pounds of carbohydrate and 0.16 pound of protein, an amount which is low, but which is far in excess of the quantity supplied by an equivalent quantity of sweet potato or cassava meal. Corn is therefore a nutritious food which only requires to be moderately supplemented by meat or other protein diet; these facts account for the great popularity of corn and corn meal as articles of diet in these islands.

It will be observed that sugar and starch are articles of food containing the maximum amount of carbohydrate but containing no protein: these substances are valuable as affording great supplies of energy, and so are consumed in large quantities by people doing hard work; they do not contain any protein, and are thus only partial foods which must be supplemented by protein-containing foods in the manner indicated when considering sweet potato and cassava meals.

The following table contains representative figures of analyses of foodstuffs commonly consumed in the West Indies. Many of the products in practice exhibit considerable variation in composition according to variety and condition, so that too much reliance must not be placed upon the individual figures given in this table. The figures will serve, however, to indicate in a general way the difference in composition between the various classes of foodstuffs, as referred to in the preceding article. It should also be pointed out that differences also exist as regards digestibility, which have to be taken into account when determining the effective food values of different products.

	Moisture	Protein	Fat	Carbo- hydrates	Fibre	Ash
Wheat flour	12.3	10.1	1.3	75.6	.3	.6
Indian corn	13.4	9.9	4.3	69.8	1.3	1.3
Guinea corn	12.5	9.3	2.0	72.3	2.2	1.7
Rice	12.6	6.1	2.0	74.1	4.0	1.2
Sweet potato	65.5	2.1	.7	29.2	1.7	.8
Cassava (root)	70.2	1.1	.4	26.7	1.1	.5
Sweet potato meal	12.6	3.6	.6	77.6	3.5	2.1
Cassava meal	11.4	2.1	1.1	82.1	1.8	1.6
Cassava bread	10.2	1.3	.7	81.9	4.8	1.1
Banana meal	15.5	2.5	1.0	77.7	.7	2.6
Plantain meal	11.8	3.7	1.0	80.7	.9	1.9
Starch				99.0		
Sugar (granulated)				99.0		
Peas (Black-eye)	13.2	17.5	1.6	61.7	2.2	3.8
Beans (Bonavist)	14.3	20.1	1.2	51.1	9.5	3.8
Salt fish	53.6	21.4	.4		—	24.6
Salt pork (fat)	7.3	1.8	87.2		—	3.7
Beef (brisket)	40.6	12.5	31.9	—	—	.7
Mutton (neck)	41.6	11.7	17.6	—	—	.7
Pork (loin)	46.1	15.1	14.5	—	—	.8

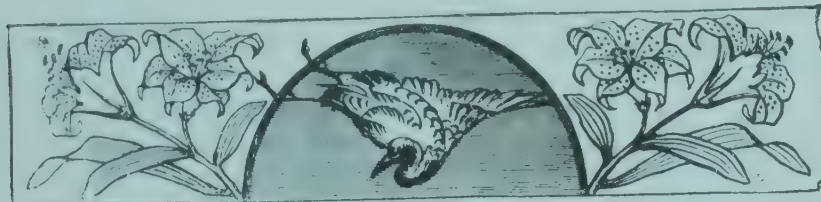
Exports of Sugar from St. Kitts.—The following figures show the annual exports of sugar from St. Kitts for the last seventeen years:—

Year.	Tons sugar.
1900	7,495
1901	12,146
1902	16,624
1903	13,511
1904	12,225
1905	12,042
1906	15,191
1907	14,178
1908	11,044
1909	12,027
1910	12,510
1911	11,139
1912	10,554
1913	11,312
1914	9,946
1915	8,341
1916	16,109

DEPARTMENT NEWS.

His Majesty the King has been graciously pleased to appoint Dr. Francis Watts, C.M.G., Imperial Commissioner of Agriculture for the West Indies, to be Knight Commander of the Most Distinguished Order of St. Michael and St. George.

The Imperial Commissioner left Barbados on February 19 for Jamaica, with the object of paying an official visit at the request of the Government of that Colony, in connexion with the development of the sugar industry and other agricultural matters. Sir Francis Watts is expected to return to Barbados in April.



DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. Mr. Joseph Jones, Agricultural Superintendent and Curator of the Botanic Gardens, states that during January, 15,000 lime seedlings were transplanted in the nurseries. Other work of a routine character was also carried out. In the lime and cacao experiment stations the crops were being picked and recorded. The prospects for the cacao generally were considered to be good. The lime crop for 1916 was computed from official export returns to be 384,298 barrels, about 6,000 barrels short of the previous year, which was the highest on record. It is of interest to note that an estimate has been prepared and submitted to the Government of the cost of erecting a Government Co-operative Factory at Grand Bay, capable of dealing with 6,000 barrels; also an estimate of the expenditure and receipts in the working of such a factory. It is said that in old cultivations the presence of certain fungi on lime trees seems to be on the increase. During the month in the chemical laboratory, a number of samples of milk were examined and a report submitted to the Government. Also a number of samples of lime juice were tested and analyses of plantain meal and banana meal were performed. Pupils received attention in field and class work as usual. The rainfall for the month was 5 inches.

MONTSERRAT. According to Mr. W. Robson, Curator, routine work at the Experiment Station included the reaping of peas and beans and distribution of bay plants, lime plants as well as 5,000 sugar-cane cuttings. At two estates, sugar-cane variety experiments were started with nineteen varieties, an event which points to the increased interest that is being shown in sugar. By January the majority of the old cotton plants had been destroyed and a considerable area of land was ready for planting the next crop, which may not be begun, however, until March 1, according to law. While the shipments of muscovado sugar amounted in 1916 to 417 tons, of value £7,828, the exports of papain did not increase. A good deal more, says Mr. Robson, could be done by small planters in the centre of the island in the matter of growing papaws. But little interest, it is stated, is being shown in maize cultivation. The onion crop, on the whole, is proving disappointing, possibly due to a dry December, though at the present time in Barbados we understand that highly satisfactory onions, part of the crop referred to, are being received in the local market and are realizing good prices. Operations at the packing house of the Onion Growers' Association began on January 17, or just a month earlier than last year. The rainfall at Grove Station for the month was 3.93 inches.

ANTIGUA. The Curator, Mr. T. Jackson, states that during January the sugar-cane variety plots were planted at several estates and from the Department's nursery a considerable number of coco-nut and lime plants were distributed as well as material for planting provision crops. No less than 105,300 cane plants were sent out during the month. A considerable amount of time was taken up in transplanting young seedling canes. About 2,000 new varieties will

be raised during the year. As regards observations relating to staple crops, the canes in January were ripening rapidly. Some few muscovado works had actually commenced grinding. Gunthorpes factory was expected to start operations about the middle of February. It is estimated that the cane crop will possibly be 20 to 25 per cent. less than last year. The onion crop was ripening in January, and reaping began about the middle of February. Though the young cane crop requires rain badly, the recent spell of dry weather has given planters an opportunity of completing their cultivation for next year's cane crop. It was expected that during the next two months considerable areas would be planted in sisal in the windward district of the island. A visit was made to English Harbour in connexion with procuring material for sisal plantations. During the month several meetings of societies were held, including a general meeting of the Agricultural Society and three committee meetings of the Onion Growers' Association, as well as one meeting of the Central Board for co-operative organizations. The rainfall for January was 2.23 inches. Rain was badly required at the time of writing.

ST. KITTS. Most of the work in the Experiment Station consisted in the reaping of the plots. As regards condition of the staple crops, Mr. F. R. Shepherd, the Agricultural Superintendent, states that the year's cane crop was feeling the effects of drought and high winds and was fast ripening up. Basseterre factory began work on February 1. Crop prospects were about the same as last season, although cane fires have reduced the yield to some extent. The young cane crop, especially the last planting has suffered from the dry weather, and in some cases replanting will be necessary. The cotton crop was practically reaped except for a few late fields. The very high price for lint, 3s. per lb. in England and 2s. 8½d. locally, induces planters to get all they can before burying in the old cotton plants. The acreage promises to be largely increased next season and the demand for best selected seed is very great. It is selling at the high price of 8s. per lb. At Spooners factory selected cotton has been ginned for saving seed and for getting samples for spinning tests. The rainfall for the month was very low, namely 1.75 inches. Work has been continued in the Government Laboratory, and included the following: milk analyses, analyses of plantain meal, juice from burnt canes, experiments in the curing of vanilla, an examination of samples of cotton lint, chemical analysis of soils and soil shrinkage determinations.

NEVIS. During December the plots at the Experiment Station were all weeded and kept in order. A good crop was expected of Mazzagua Guinea corn. The Barbados white eddoes were reaped during the month and a good yield obtained. Corn was obtained at the rate of 1,500 lb. of corn on the cob per acre. The onion crop continued to make good progress and a part of the crop was showing signs of ripening. The distribution of planting material from the Station during the month was as follows: sweet potato cuttings, 2,500, black-eye peas 1 lb. together with 18 lb. of seed corn. Mr. Howell, the Agricultural Instructor, reported that the cane crop continued to be promising. The planting of next season's crop was in progress. Cotton at the time of writing was in full progress but it was not anticipated that the second picking will be very good on account of leaf-blister mite and boll shedding. The rainfall for the month was 4.74 inches. The rainfall for the year 1916 was 64.04 inches.

TORTOLA. In the Experiment Station, Mr. W. C. Fishlock states that plot No. 5, which had been planted with sweet potatoes before the hurricane of October, was recultivated

and planted with twelve varieties of sugar-cane. Plant distribution consisted of 15,400 onion seedlings, 228 corn cobs, $4\frac{1}{2}$ lb. of peas, 14 lb. of Irish potatoes. The cotton crop was expected to be small and there was no indication of there being any lime crop for some time. The sugar-crop was also considered likely to be poor. Food crops have been receiving attention and potatoes at the beginning of January were plentiful. The weather was exceptionally dry for December. Rain fell in measurable quantity on only twelve days of the month.

AGRICULTURAL CONDITIONS IN BARBADOS.

The following consists of extracts from a report in the *Barbados Agricultural Reporter* for February 10, 1917:—

The closing days of January were fairly showery in the greater part of the island, but there has been no heavy rain to entirely relieve the tension which is being felt in respect to the regular and general establishment of the young crop. On the 28th of the month very refreshing showers fell in one of the driest parts of the island: viz., the north-western portion of St. Lucy's parish. It was quite a pleasure to find two days later how wet the fields in this neighbourhood were.

In the hilly districts the rainfall for January was generally over 4 inches, while on a few estates nearly 6 inches were registered. In the greater part of the low-lying parishes the rainfall for the same period has been slightly over 2 inches; the result in each case of about seventeen showery days. The eastern side of St. Philip and the southern part of Christ Church have not participated in the favours that have been received elsewhere, and these districts are passing through a period of real drought.

The past fortnight has not proved long enough to complete the field work in connexion with the planting of the young crop. In most districts some forking, moulding, draining, manuring and head-row weeding have been done, and some still remains to be done. In some instances, we have observed that the earth had grown too hard to entirely put out of hand fields in which such work was in progress. At this time of the year there are always a few fields in which some tillage remains to be done, but few planters can remember a year in which preparation was so backward. It remains to be seen to what extent this will affect the crop to be reaped in 1918. With all their difficulties, however, there is one satisfaction which the planters have experienced. They have been enabled, even in the grassiest districts, to rid their open fields of the perplexing pond grass and other weeds.

Every planter has been busy with the supplying, which has meant, in some instances, the re-planting of the young crop. Wherever there have been showers, the supplies have grown healthily and, we may add, with regularity. A planter on a black soil estate tells us that he is quite satisfied that his crop is fairly well established. This favourable verdict cannot, however, be given of every district. We have noticed fields in which the shoots which are as yet visible are very few. But at the same time alongside of a field in this condition there is another which presents a most pleasant sight—green blades waving above almost every bank. The difference is principally to be accounted for by the time of planting,

but it may also be the result of the difference in the condition of the soil.

The early tillage of fields is a considerable factor in the production of good crops, and money spent in exposing the subsoil by deep forking, moulding and draining is a good investment. The soil is thereby improved, and plants are strengthened to resist droughts and to fight against their enemies. Our attention has recently been drawn to a piece of land in which some moulding was done. To a hole it could be seen where the new earth had been scattered. The dry weather had not retarded the growth of the plants in that part of the field in which new soil had been placed, while the plants in the remainder of the same field gave ample proof of the hard weather they were encountering. Thorough and liberal tillage is almost as beneficial as manure.

Reaping operations have been generally started. In some parishes every estate is either grinding or sending canes to the factory. In the red soils there are a few estates which will not begin before the middle of this month or perhaps a little later.

The quality of the juice, as far as we can learn, is not disappointing, but the return is irregular. From St. James' parish the following figures have been reported: 18, 20 and 26 tons cane per acre. In St. Philip's parish a yield of 32 tons have been reached. The B.376 is mentioned as having dried very much and as being likely to mark a tonnage much lower than other varieties. We have heard it estimated that this year's crop will be about 12 per cent. or one-eighth less than the crop reaped last year. At a visit to one of the factories, we are pleased to learn that canes were being purchased from the peasant proprietors on the same basis as from the estates; viz., 7 lb. crystals per 100 lb. cane.

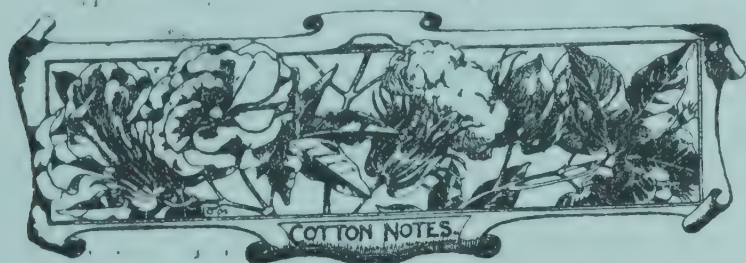
Of the twenty-one factories and estates at which dark crystals are made, fourteen are at work. We regret to have to state that one of the mills at Three Houses has been seriously broken: this will no doubt cause considerable inconvenience, as several estates are concerned.

The factory at Andrews has been improved and a vacuum pan has been imported, but there was not sufficient time to have it ready for this reaping season. Centrifugal muscovado will therefore be made, and canes are being purchased on the usual dark crystal basis.

Yesterday there was no quotation for centrifugal muscovado. The market for dark crystals opened at \$3.25. Molasses is apparently firm at 15c. per gallon and \$5.00 for Fancy, and 20c. for Choice.

The yam crop is being rapidly disposed of generally at \$1.00 or \$1.20 per 100 lb., but in St. Lucy's parish \$1.50 per 100 lb. is being asked. White eddoes are selling at \$1.00 per 100 lb. and nut eddoes at 90c. Potatoes are being sold at \$1.08 per 100 lb. and retailed at 7 lb. for 10c., and we are informed that in some districts they are growing very scarce. The Guinea corn crop has not been a plentiful one, as it was not planted in sufficient quantity. In spite of a dry December it eared satisfactorily. This corn is being sold at 7s. per bushel.

There have been twenty-one cane fires since the date of our last report, making a total of seventy-eight, causing the destruction of 371 acres of canes. During the fortnight 106½ acres were burnt and more than half this total was destroyed at two estates—Foursquare, in St. Philip's parish, and the River, in St. Andrew. These facts call for the devising of a remedy which will effectively protect property against wanton interference.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland, of Liverpool, write as follows, under date January 22, 1917, with reference to the sales of West Indian Sea Island cotton:—

All descriptions of Sea Island cotton have remained very firm since our last report, and sales of Montserrat cotton have been made at 34d. to 36d.

Buyers are anxious for a larger supply, and we anticipate that all shipments will be eagerly purchased on arrival at good prices. It is very doubtful if there is enough Sea Island cotton to go round.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ending January 27, 1917, is as follows:—

ISLANDS. With the absence of demand the market remains dull and nominally unchanged. The factors are holding their limited offerings of previous prices, hoping that in a short time a demand will spring up admitting of their selling without having to make any great concession to do so. Under these circumstances we have only to repeat our last quotations, viz:—

Fully Fine	53c. = 55c.	landed.
Fine	50c. = 52c.	„
Fine, slightly off	48c. = 50c.	„

GEORGIAS AND FLORIDAS. There has been some inquiry, and sales have been made of a few small lots, which were probably placed at some concession in price. However, there is no general demand, consequently the markets are very quiet, with the holders of cotton showing more disposition to sell, and are becoming less hopeful of disposing of their holdings at the high prices which were current. Consequently, with orders in hand some lots can be bought at concessions.

We quote viz:—

GEORGIAS AND FLORIDAS.

Extra Choice to Fancy	50c. = 51½c.	landed.
Choice to Extra Choice	48c. = 49½c.	„

With orders in hand we can buy occasionally 1c. to 2c. lower.

The exports from Savannah for the week were, to Northern Mills 293 bales, and to Southern Mills 217 bales, and from Jacksonville to Northern Mills 200 bales.

The United States Census Bureau reports cotton ginned to January 16, as follows:—

South Carolina	3,258 bales	} making a total of 115,463 bales.
Georgia	76,328 „	
Florida	35,877 „	
Against last year	90,736 „	Total crop
„ 1915	79,484 „	85,278 „
„ 1914	76,188 „	78,857 „
„ 1913	70,760 „	85,544 „
		66,169 „

THE BRITISH COTTON GROWING ASSOCIATION AND WEST INDIAN PLANTERS.

We publish for general information the following letter, received by the Imperial Commissioner of Agriculture for the West Indies, from the British Cotton Growing Association relative to the sale of West Indian cotton:—

Manchester,

January 19, 1917.

Dear Sir,

We have been informed that certain statements have recently been made in the West Indies which seriously affect the character and reputation of this Association.

2. These statements may be briefly summarized as follows:—

(i) That planters will do better by selling their cotton direct to the spinner, as this Association purchase cotton on their own account and make a profit on the transaction.

(ii) That some of the Lancashire spinners are of opinion that the Association are not doing their best to encourage the cotton-growing industry in the West Indies.

(iii) That planters will do better by selling their cotton through other agencies than the Association, as these agents will be able to sell cotton to spinners with whom the Association have no commercial relations.

3. We should be much obliged if you would contradict every one of these statements.

4. As regards the first statement, we beg to inform you that we have not bought a single bale of West Indian cotton on our own account, and that we have always paid the planters the full price which we have actually received less out of pocket charges and the usual brokerage of one per cent. We must also insist on the fact that the Association have only one object in view, viz. the extension of the cultivation of cotton throughout the Empire. We are of opinion that the best method of attaining this object is to pay the planter the best possible price which the market will allow, so as to encourage him to continue the cultivation of cotton, and to increase the acreage under cotton as much possible.

5. There is no foundation whatever for the second statement. The Association have nothing to gain by reducing the price, rather the contrary, whereas it is to the interest of the spinner to buy his cotton as cheaply as possible.

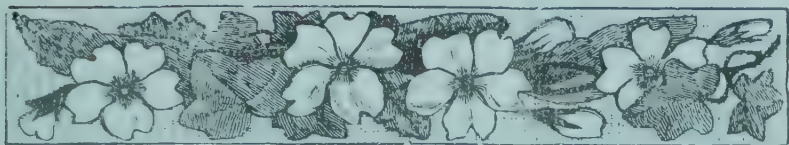
6. The third statement is also untrue, for the Association are in close touch with all spinners who use West Indian cotton not only in England but also in other countries in Europe.

7. We should be much obliged if you would publish this letter, and also if you would at the same time inform planters that we shall be very grateful if they will send us—either confidentially or otherwise—any information which will enable us to put a stop to these libellous statements.

Yours faithfully,

(Sgd.) J. ARTHUR HUTTON,

Chairman, British Cotton Growing Association.



MANURING OF CACAO IN BRITISH GUIANA.

It is stated in the *Demerara Daily Argosy* (January 20) that the sole objection to the use of heavy mulching for cacao is the expense, four years' mulching costing \$66 per acre. As a matter of fact it is not the expense but the low return that is the trouble in British Guiana. Sixty-six dollars per acre for four years is \$16.50 per acre annually, which compares very favourably with \$19.20 per acre per annum in Dominica, where mulching has been shown to be remunerative. But in Dominica, the average annual gain in cured cacao by mulching is 626 lb. compared with 124 lb. in British Guiana. There are two important points to be considered in connexion with the value of mulching in these experiments: (a) the fact that a dressing every other year might produce as good a result as an annual dressing, and (b) the fact that apart from actual gain in yield, the trees are improved in health and vigour of growth. The following is the account of the British Guiana results, referred to above:—

The sole objection to the use of heavy mulchings is the expense, four years' mulchings costing \$66 per acre. The value of the excess of cacao at the price of 12½c. per lb. of cured cacao obtained during seven years if taken at the lowest indicated return—520 lb.—is \$1.00 less than the cost of the mulching; whilst at the highest indicated rate of increase—894 lb.—it is in round figures \$46 in excess of the cost of mulching.

The total cost of the four manurings with phosphates and potash was \$16 per acre. The lowest indicated excess yield during seven years was 472 lb., the maximum 992 lb. The minimum shows a profit from their application of \$43, the maximum one of \$107. The chance of obtaining enhanced yields by the combination of mulching with manurings of phosphates and potash is a good one, and hence future trials will be principally directed towards examining into its feasibility.

CULTIVATION METHODS RECOMMENDED.

The experiments which have now been carried on for a period of fifteen years indicate that in British Guiana under conditions similar to those existent at Onderneeming farm, the methods of cultivation precedent to the successful growth of cacao are:—

- (1) The reduction of 'shade' to the lowest amount compatible with due protection from wind.
- (2) Deep and efficient drainage; certainly not less than from 3 to 4 feet.
- (3) Annually forking the land between the trees in such a manner as not to injure the roots more than is absolutely unavoidable, while effectually loosening the soil for aeration and drainage and thus constantly adding to the depth of tilled surface soil and the feeding area available for the roots of the trees. To do this requires the service of skilled forkers working under strict supervision.
- (4) Mulching the soil, but only so far as can be done at low expenses, such expense not exceeding \$6 per acre.
- (5) Manuring the trees with a mixture of superphosphate of lime and sulphate of potash. The cost of such application should not exceed \$4 per acre.

The Question of Deforestation in the Virgin Islands.—In some quarters it is the popular idea that the unwooded character of much of the mountain land in the Virgin Islands is the result of the promiscuous felling of trees which it is assumed has been carried on for many years. As a matter of fact there is evidence to show that the unwooded character of a great deal of the land in Tortola and elsewhere is a natural feature of the islands. Through the courtesy of Mr. William Fawcett, B.Sc., of the British Museum (Natural History) we have been furnished with an extract of much interest taken from a letter in a book entitled, 'The Northmen Columbus and Cabot', published by C. Scribners Sons, New York, 1916. This letter, which is translated in the book referred to, was written by Dr. Chanca, the surgeon who accompanied Columbus on his second voyage. The extract runs as follows: 'On the morning of the following day we coasted along it [Santa Cruz] and found it to be a large extent of country, but not continuous, for it was divided into more than forty islets [Virgin Islands]. The land was very high and most of it barren, an appearance which we have never observed in any of the islands visited by us before or since: the surface of the ground seemed to suggest the probability of its containing metal.' The above is very interesting, and as already stated would appear to indicate that the Virgin Islands have never been a thickly wooded area such as one is accustomed to see in the case of other islands in the West Indies.

Rubusta Coffee in St. Lucia.—The Agricultural Department in St. Lucia has issued another leaflet dealing on this occasion with Robusta coffee as an additional crop for that island. Instructions as regards cultivation and preparation for the market are given, and a note is included on the local conditions and market. It is stated that Robusta coffee of all species is likely to thrive best in St. Lucia. It is not recommended that any estate should be devoted entirely to this crop, but it is held that there are many estates the revenue of which could be increased by the addition of a few acres of this plant. The condition of the local market for coffee is such that it has been necessary to supplement the local supply by the importation of an average of 68,209 lb. annually, valued at £1,813. The possession of natural conditions for the successful cultivation of this crop should stimulate planters to give it increased attention with a view to causing a cessation of imports of coffee and, if possible, the production of an export trade.

The Growing of Asparagus in Nevis.—An interesting old work entitled, 'Natural History of Nevis', by the Rev. John Smith, contains a reference to the growing of asparagus in that island many years ago. It says: 'In the mountain plantations, where only asparagus can grow, I have known it to cut within the small space of three calendar months, reckoning in the time of its being sown in buds that came from London: for there we never transplant the roots. We are obliged to let it run up to wood, in order to shade the bed from the scorching rays of the sun, and the young ones that grow up under that wood we cut to boil. But this soon eats out the heart of the compost and soil; so that a bed will not hold good much above two years, and the asparagus never grows big.'

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in the present issue deals with the subject of human food requirements. The table appended gives figures of analyses of foodstuffs commonly used in the West Indies.

Insect Notes, on page 58, discuss wind as a factor in the dispersion of certain insects.

Results of experiments in connexion with the making of bread from wheat flour diluted with sweet potato meal, carried out in St. Lucia, are given on page 59.

Fungus Notes, on page 62, deal with the rind fungus of sugar-cane.

Dominica Rainfall, 1916.

Mr. Joseph Jones, Curator of the Botanic Gardens Dominica, has kindly forwarded a printed copy of the Dominica rainfall returns for 1916. The monthly rainfall is recorded for thirty-three stations. The mean rainfall for these thirty-three stations is 125.70 inches; for the twelve leeward coast stations, 91.99; for the three windward coast stations, 147.62; for eleven inland stations, 160.65; and for seven Lasoye stations, 119.16 inches. In comparing these figures with those for 1914 and 1915 we notice that the rainfall during the past year has been above the average. In 1914 the mean precipitation for thirty-two stations for the year was 109.85 inches. During 1916 the highest return was from Gros Manioc, at which station 247.26 inches were recorded. The rainfall for the year at the Botanic Gardens was 84.42 inches.

Women and Agriculture in Great Britain.

The continued demand for more men for the Army has necessitated calling up many engaged in what have hitherto been regarded as reserved occupations. Until recently the more highly skilled workers on farms have been exempt; the exigencies of the war have now altered this, and agriculture has been depleted of its labour to a serious extent. The scarcity of labour has been met in various ways: by the loan of soldiers for harvesting operations; by the organization of school-boy labour during the holidays, and by the employment of ex-service men. But it is to women, particularly of the better classes, that attention has been especially directed, and a great deal has been achieved in connexion with their employment on the land. Articles have recently appeared in the *Journal of the Board of Agriculture* of England and Wales on the subject. In the latest issue of that Journal, an account is given of two training centres for women, which it is understood have done good work in turning out capable female workers, familiar not only with such operations as milking and butter-making, but also with the more vigorous farm operations such as ploughing. Illustrations are given of women cleaning and littering stables, and of two girls using unaided the self-binder with three horses, showing what can and ought to be done in a crisis. After all, it is convention that has been the chief barrier in the past to the employment of women on the land in Great Britain. At the same time there are real objections. On the Continent important branches of agriculture are market gardening and the cultivation of the grape vine—industries which are more suited to women labour than the management of live stock, which nearly always forms an integral part of British farming systems. However, in war-time the objectionable aspect of things fades into imperceptibility in the light of national necessity, and this should be so in regard to the employment of women on the land.

As in other important matters connected with the war, we sometimes hear of cases that are not without a touch of humour. Readers of the *Sporting*

and *Dramatic Journal* will appreciate the happy combination of ingenuity and regard for personal comfort on the part of the lady who is pictured towing a mowing machine and man operator across a hay-field in her 80 h.p. Daimler. The car is running on bottom gear, and in spite of the strain on the engines, the experiment is reported to have been successful. Pieces of rope were tied equidistantly around the back tyres in order to make the wheels grip the somewhat slippery surface of the field. While acknowledging the novelty of this form of traction, one is inclined to question its economy, as well as its necessity, unless, as seems unlikely on the farm, a horse was not available.

The Resources of the French and Foreign Colonies in the Tropics.

A copy has been received of the *Annales du Musée Coloniale des Marseilles* (3rd series, Vol. IV, 1916) consisting of a general account of recent investigations into the resources of the French and foreign colonies in the tropics. Algeria is the first country dealt with, then Tunis, Morocco, and French East and West Africa. Considerable attention is given to the resources of Madagascar, and a large amount of space is devoted to similar matters in French Indo-China. Of interest in the West Indies will be that section dealing with recent work in Martinique and Guadeloupe, as well as in the British islands and in British Guiana. An account of work in the American and Dutch tropics is included. The whole publication forms a very useful compilation, and although the information which it records does not appear to be more up-to-date than the year 1915, it will nevertheless serve as a useful source of reference for information concerning agricultural work in foreign tropical countries. The author is M. Henri Jumelle, Professor at the Faculty of Sciences and Director of the Colonial Museum of Marseilles.

The Production of Rice and Provision Crops in British Guiana.

The development of rice growing in British Guiana has been one of the most striking features of the colony's progress. We learn from the Report on the Department of Science and Agriculture that from 1903 to 1914 the area under cultivation in rice increased from 17,503 British acres to 47,037. During the year under review the acreage was 50,737 acres, an increase of 3,700 acres on the acreage reported for 1914; 13,600 acres equal to 26.8 per cent. of the area under rice are situated within the empoldered areas of sugar plantations.

The relation of the rice-growing industry to the sugar-cane and other agricultural industries of the colony during the period 1903 to 1915 is summarized

in the following table, in which the areas occupied by the varied industries are given in British acres:—

	Sugar-cane.	Rice.	Other products.	Total areas under cultivation.
1903	78,860	17,503	21,442	117,805
1904	74,424	23,016	28,338	125,778
1905	76,011	25,347	30,940	132,298
1906	78,158	27,898	30,317	136,373
1907	74,441	31,196	27,943	133,580
1908	74,865	39,746	33,356	147,967
1909	73,224	27,540	31,901	132,760
1910	73,319	33,264	36,651	142,139
1911	72,138	37,826	40,487	150,451
1912	71,808	44,020	43,132	158,960
1913	72,698	35,582	43,832	152,072
1914	73,108	47,037	49,389	169,534
1915	75,744	50,737	49,888	176,369

In regard to provision crops, the *Demerara Daily Argosy* says:—

The total acreage under these was 19,820 acres, or 1,243 acres less than in the previous year. It is much to be regretted that under existing war conditions the farmers of the colony have not realized the necessity, from the point of view of the prime importance of abundance of colony-produced foodstuffs for the benefit of the poorer sections of the community, of continuing the policy inaugurated in August 1914, of steadily increasing the area under such products. In that year the farmers increased the area under foodstuffs by 2,604 acres over that planted for 1913; that increase is now lessened to, in round figures, 1,360 acres. The area under foodstuffs is, however, still higher than it has been since these records were commenced.

The Resistance of Budded Cottons to Disease.

Mr. Harland states in the report of the Agricultural Department, for St. Vincent 1915-16, that during the year a study was made of the resistance of budded cottons. The budding of cottons is a simple operation. A young plant about 2 feet high can be used as stock, the bud being inserted about 1 foot from the ground. Provided that the sap is flowing freely in both stock and scion, it is immaterial whether petioled or non-petioled budwood is used, or whether the stock and the branch from which the bud is taken are approximately of the same diameter or not.

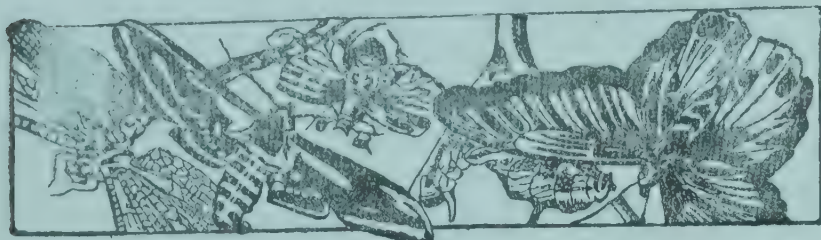
The following conclusions are arrived at from a study of the behaviour of budded cottons:—

(1) If the stock is susceptible and the scion immune, the scion retains its immunity completely.

(2) If the stock is immune and the scion susceptible, budding apparently confers on the scion a certain degree of resistance.

(3) If the stock is fairly resistant and the scion susceptible, the scion remains susceptible, though perhaps not so susceptible as when on its own roots.

(4) If the stock is susceptible and the scion fairly resistant, the same degree of resistance is retained by the latter.



INSECT NOTES.

WIND AS A FACTOR IN THE DISPERSION OF CERTAIN INSECTS.

In the insect world when the competition for existence in a given locality becomes too intense owing to overcrowding and consequent lack of food, the pressure can usually be relieved by dispersion to new localities. Some insects, such as locusts, are very active at all stages of their lives and never have any difficulty in moving wherever they will by their own efforts. Others, for example some moths or beetles, are comparatively helpless in the larval stage and can only spread as winged adults. Both these groups of insects are practically independent of the wind, as are most of the larger and stronger insects, although at times a strong wind does help them in their long flights. There is, however, a large group of minute and comparatively helpless animals which can only travel short distances by their own powers of locomotion, and, but for the fortuitous help of certain artificial or natural means of dispersal, might, under certain conditions have great difficulty in obtaining sufficient food.

To this group belong such forms as scale insects, red spiders and other mites (classed with insects for convenience), and similar microscopic animals.

It has been shown that the spread of these minute forms, many of which (as in the case of scale insects), remain fixed to one spot for the greater part of their lives, is often due to man in his cultural operations or other activities, to birds, and to other insects. These agencies may cause their dispersion to considerable distances, but spread by this means can in the case of man be controlled to a great extent, by rigid inspection.

Recent experiments have shown that red spiders, scale insects, etc., may under certain conditions be transported through the agency of wind much farther than was formerly thought possible, and this definite information has an important bearing on the control of these forms. A brief account of some of the experiments made in this connexion may be of interest to readers of the *Agricultural News*.

It has been known for some time that red spiders, or more correctly spider-mites, may be blown from one tree to another in an orchard, but it was generally considered that an open piece of ground between two orchards, or a similar barrier, was sufficient to prevent a spread of these pests from one orchard to another. Experiments made in California in 1913 (*California Monthly Bulletin*, 2, 12, p. 777) by E.E. Munger, and later in the same year by H.P. Stabler in connexion with the almond mite (*Bryobia pratensis*) showed that these small animals may be blown by the wind to a considerable distance. Sheets of sticky paper were placed at varying distances from a 10-acre orchard of large almond trees, and at different elevations so as to face the prevailing winds. Numerous spider-mites were found on the sheets placed at a distance of 650 feet, and at an elevation of 50 feet from the infested orchard, and on sheets placed at the shorter distances. These experiments were repeated

with precautions to preclude all possibility of the red spiders having reached the paper in any other way than by wind carriage. The results were again the same, and it is regarded as established that red spiders are blown sufficiently far to make infested orchards a menace to other orchards within reasonable distances.

In California where citrus orchards infested with scale insects are fumigated in such a way that practically all of the insects are killed, this question of the reinfesting of treated groves from neighbouring infested groves is a matter of no small importance.

In the *Journal of Economic Entomology* for October 1916, we have an account of some experiments made by Professor H. J. Quayle, of the University of California, on the 'Dispersion of Scale Insects by the Wind'. Previous experiments made in 1912 by Professor Quayle on the locomotion of young scale insects showed that it is hardly possible for these small animals to travel over the surface of the soil from one tree to another by their own powers of locomotion. As mentioned above, it is known that man, birds and even other insects may be responsible for the spread of scale insects to considerable distances, but recent experiments have shown that wind plays a very important part in the dispersion of young scales throughout an orchard, and to adjoining orchards.

The results of the first series of these experiments showed that young black scale (*Saissetia oleae*) were carried by the wind for varying distances up to 450 feet from infested trees. Tanglefoot sheets were placed in different situations and at different distances from infested trees. The prevailing wind was from the west and south-west, and many more scales were caught on the sheets facing west and south than on those having a north and an east exposure. These experiments were carried out simply to determine to what extent the young of the black scale might be caught on tanglefoot fly paper, and only lasted over a period of two or three days, as it was found that in that time the sticky material on the sheets became hardened in the sun. It may be mentioned that these experiments and those given below were conducted towards the end of June when the definite annual production of young scales was in progress, and it is evident that the dispersion by wind takes place mainly during the period of young production from April to September in California. Further experiments along the same lines as the above were made in September after the hatching of the scales was over, and very few scales were caught on the tanglefoot sheets.

Another series of experiments was made by Professor Quayle to determine to what extent a grove freed from scale by fumigation can be reinfested from neighbouring orchards which were covered with young scales.

A 4-acre block of citrus trees was chosen which had been thoroughly fumigated in 1914 so that practically 100 per cent. of the black scale was killed. An examination of this block in April 1915, before the annual hatching of young scales began, showed that no scales were then present. This block of clean trees was surrounded by severely infested orange trees on the west, south and east sides, while on the north side was an abrupt slope of barren ground. The trees were examined again in August 1915, and from tests made it was found that young black scales were distributed throughout the entire 4 acres of trees, without question chiefly by the wind. The tests also showed that the spread was mainly in the direction of the prevailing south-west wind.

These experiments are only of a preliminary nature, but, so far as they go, establish the fact that, under certain

conditions, wind is largely responsible for the spread of young scales insects, and show how easily a clean orchard may be infested from neighbouring orchards, or from other host plants growing in the vicinity.

There is no doubt that the wind is a factor in the spread of such small insects as thrips, white flies, plant lice, etc. during the periods when these are most active. This question of dispersion by wind is of special importance in the case of an insect which has several alternate host plants, when it is quite possible for an insect to be carried by the wind from its wild host plants to its alternate host plants of economic value. Under West Indian conditions many of these minute forms are usually controlled by their parasitic, predaceous, or fungus enemies, or they can be kept in check by good methods of cultivation.

The data presented in this article further emphasize the importance of thorough co-operation between growers in all measures of control, especially where a pest is known to be prevalent over large areas.

J.C.H.

ECONOMY IN USING POTATOES.

An article appears in the *Journal of the Board of Agriculture* of England and Wales on economy in using potatoes. Trial has shown that the most common method of cooking potatoes—paring, then boiling after placing the pared tubers in cold water—is the most wasteful method practised. This is so for three reasons: first, not only the skin, but the surface layer and perhaps 10 per cent. of the flesh are removed by thick paring, partly owing to deeply sunk eyes and surface irregularity; the total loss may, indeed, amount to as much as 20 per cent. of the whole tuber—or 1 lb. in every 5 lb. The surface layers, which are wasted, contain a larger percentage of solids than the remainder; and lastly, the subsequent boiling dissolves the soluble ingredients of the potato and also breaks down the outer surface into the water—which is thrown away.

Experiments on the subject have shown that pared potatoes put into cold water and boiled lost 15.8 per cent. of their protein or flesh-forming substances, 18.8 per cent. of their ash or mineral matter, and some 3 per cent. of their carbohydrates or starch. Plunged at once after paring into boiling water and boiled, they lost 8.2 per cent. of their protein, about 18 per cent. of their ash, and a small amount of their starch. On the other hand, when boiled in their jackets, potatoes lost only 1 per cent. of their protein, a little over 3 per cent. of their ash, and practically none of their starch whether plunged in cold or hot water at the start.

It is clear, therefore, that if pared potatoes are placed direct in boiling water, the loss in boiling is very much reduced compared with the usual methods—placing in cold water; steaming instead of boiling also reduces the loss; while boiling or steaming in their jackets reduces all losses to a minimum—both the boiling losses and the primary 20 per cent. loss due to paring are almost wholly avoided.

Considering the facts already outlined, in cooking for the table, potatoes should be boiled or steamed in their jackets. Slow cooking is desirable so that the skin does not bake on to the flesh and so cause loss. The skin should be pricked or cut before baking to permit the escape of steam. If because of injuries to the surface or for any other reason, potatoes must be pared, they should be cooked by steaming, or by cooking in the smallest possible quantity of water, which should be boiling when the potatoes are put in. The water

should not be thrown away but should be used as a basis for soups. The same applies to the cooking of beans. The loss in boiling is reduced if salt is added to the water.

As a general rule with all vegetables, it is more economical to steam them rather than to boil them. The information given above refers primarily to English potatoes, but the general principles hold good for sweet potatoes and yams and other West Indian vegetables. In view of the high cost of living in the West Indies and the possible shortage of food in the future, it will be well to bear the foregoing facts in mind, as it will be seen that the preparation of vegetables for the table is in many cases accompanied by a very considerable loss of nutrient material.

BREAD DILUTED WITH SWEET POTATO MEAL.

In connexion with the notes on bread diluted with potato meal which recently appeared in the *Agricultural News*, the following notes on experiments that are being conducted in St Lucia, forwarded by Mr. A. J. Brooks, Agricultural Superintendent, are of interest.

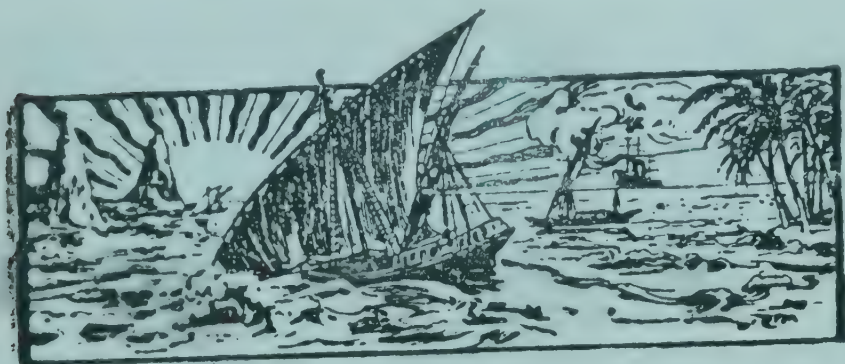
The initial experiments gave a $\frac{1}{2}$ -lb. of dried flour per 2 lb. of freshly dug sweet potatoes. The potatoes were carefully scrubbed clean and then cut into thin slices and dried in an ordinary oven. When dried to such an extent that it became brittle, the slips were placed in a mill and carefully ground to a very fine powder. Mr. Brooks has kindly forwarded a sample of this meal which seems good and palatable. Drying in an ordinary oven however, has had the effect of slightly caramelizing the sugar in the meal, thus imparting a cooked flavour and at the same time darkening the product. This can be got over by drying at a lower temperature, or by sun drying, though it may be thought by some that the features produced by baking are not objectionable.

Samples of loaves of bread were made from the following mixtures: wheat flour 3 parts, sweet potato flour 1 part; equal parts of wheat and potato flour. Very satisfactory bread was made from the 3 : 1 mixture. The colour and consistency were rather like brown bread. Bread made from equal parts of these flours was not as satisfactory.

Probably the colour of sweet potato flour could be improved upon by modifying the method of drying. Mr. Brooks states that the question of slicing the potato is receiving attention, as it is important to reduce the cost of preparing sweet potato flour to the lowest possible point. At present satisfactory results are being obtained by adapting a poultry chaff cutter to suit the requirements.

It is understood that experiments are also being conducted in connexion with the manufacture of bean flour with the object of using it in conjunction with wheat and sweet potato flour.

Viability of Kiln-dried Corn—In regard to the interesting question of the viability of kiln-dried corn, several tests made in St. Vincent have shown that the percentage of germination runs from 23 to 26. This of course is too low to make kiln-dried corn of much value for planting purposes.



GLEANINGS.

What is probably the most remarkable collection of *Agaves* is said to be that in the gardens of Professor G. Roster, of Florence, who has spent twenty years in cultivating tropical plants. The *Gardener's Chronicle* states that the collection includes 842 species of *Agaves*, of which twenty-seven have flowered since 1889.

The international movement of fertilizers and chemical products useful to agriculture is dealt with in No. 5 of the Bureau of Statistics of the International Institute of Agriculture, Rome. The figures given indicate the almost complete cessation of trade in potash salts with the exception, perhaps, of German trade with Holland, Denmark, and Scandinavia.

According to *Colonial Reports* - Annual, No. 908, on Bermuda, the quantity and declared value of arrowroot exported in 1915 were 5 tons, valued at £650, as compared with 4 tons 5 cwt., valued at £530, in 1914. The quantity and value of onions exported during the last two years were: 1914, crates 87,279, value £25,877; 1915, crates 153,416, value £22,955.

A new rubber sponge made by a wet process direct from rubber milk or latex is referred to in the *India Rubber Journal* for December 2, 1916. It is said to resemble the natural sponge in appearance, and unlike the red rubber sponges, it swells and grows soft in water. It would seem to possess disadvantages, however, when compared with the natural article. It has to be kept moist, and if exposed to sunlight it tends to deteriorate.

An abstract of the proceedings at the meeting of the agricultural section, British Association, last year, appears in *Nature* for December 14, 1916. The topics discussed can be roughly grouped under the three heads of Economy in Crop Production, Economy in Meat Production, and Economy and Reform in Timber Production. It will thus be seen that the proceedings dealt with the aspects of agriculture related to the war.

A notice appears in the *St. Lucia Official Gazette* for November 19, 1916, that 70,000 lime plants will be ready for distribution from the Agricultural and Botanical Station between May and November 1917. Planters were advised to send in their orders at once, otherwise it would be impossible for the Agricultural Department to guarantee delivery. Owing to the increased cost of raising due to the losses incurred from fungoid and insect pests, the price was raised to 3s. per 100, from January 1, 1917.

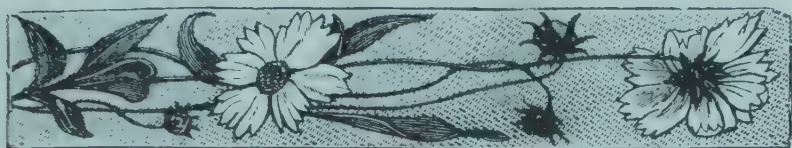
The minutes have been received of a meeting of the Grenada Board of Agriculture, which was held at the Botanic Station on Wednesday, December 13, 1916. The Superintendent of Agriculture, Mr. J. C. Moore, was in attendance. Opportunity was taken of viewing certain features of the Station. Various administrative matters were discussed. In regard to the plant and animal diseases, it was decided to increase the expenditure from £10 to £50 in order that further investigations and experimental work might be conducted under this head.

The opinion is expressed in the *Queensland Agricultural Journal* for November 1916, that the returns of cassava in that country should be as good as those obtained in Jamaica, where 20 tons per acre are easily produced. An illustration is given of a field of cassava in Queensland which affords striking evidence of the truth of the suggestion. Cassava compares more than favourably with maize and potatoes in regard to the yield of starch. From an acre of cassava 5,000 lb. of starch may be obtained, whereas an ordinary crop of maize may not give more than 1,200 lb. of starch.

Since the South Orkney Observatory was established in 1903, the August and September temperature there has been a direct index of the temperature at Kimberley, South Africa, during the three months following. The temperature during August and September at the South Orkneys is largely dependent on the ice conditions of the surrounding ocean, and as the ice is moving east-north-east, it is feasible to suppose that the temperature prevailing over the South African plateau is related in some way to the antecedent conditions in the great southern ocean. (*The Geographical Journal*, Vol. XLVIII, No. 6.)

A note appears in the *Journal of the Board of Agriculture* for December 1916, to the effect that numerous attempts have been made by the English Agricultural Organization Society to initiate a satisfactory system of credit in the country, and some fifty credit societies have been formed. Their success has been very limited, and the number, in comparison with other countries where they exist in thousands and are most successful, is totally inadequate. An interesting note also appears in the same journal on cattle insurance societies in India. It will be remembered that a suggestion has been made to form such a society in Antigua, in the West Indies.

At a recent meeting of the Trinidad Board of Agriculture, the question of how to increase the breeding of live stock in Trinidad was discussed. Practically all the Trinidad meat supply comes from Venezuela at present, which is an insecure state of affairs on account of the war. It was suggested that more should be done in selecting good breeds for meat and draught purposes separately; but it would appear that the principal requirement is to increase the number of animals in the island irrespective of breed, in view of the urgency of the existing situation. It should be remembered that the raising of live stock means a production of manure which is badly needed on most cacao estates in Trinidad, so that for more reasons than one, there ought not to be any opposition to the proposals that have been made by the Board of Agriculture.



THE HINTERLAND OF BRITISH GUIANA.

Mrs. Cecil Clementi contributes to *The Geographical Journal* for December 1916, a very interesting and readable account of a journey through the hinterland of British Guiana, and to the summit of Mount Roraima. Mrs. Clementi was accompanied by her husband Hon. Cecil Clementi, C.M.G., Government Secretary, British Guiana, and by Mr. Menzies, one of the few pioneers of the interior of the colony. The following is what Mr. Clementi adds to the story, with regard to Mr. Menzies' land. It indicates the great agricultural possibilities of the interior, a matter on which considerable scepticism exists even in Georgetown, the capital of the colony:—

Mr. Menzies' tableland is a flat grassy plateau some 2,400 feet above sea-level. It is bounded on the east by the Kowa River, on the north-west and south-west by the Chiung River, both flowing in rifts far below the plateau level, and on the south-east and north by hills which divide the Kowa from the Chiung Valley. Its extreme length from north to south is 7 miles, and its extreme width from east to west is some 8 miles. Its area is roughly 50 square miles; and the distance across the plateau by our trail, which ran in a tolerably straight line, I estimate at 5 miles. The whole tableland forms an excellent grazing ground; and although there was at the time of our visit no water on the central part of the plateau, there were many streams at its edges falling into the Kowa and the Chiung, while across it ran a few dry channels, which are no doubt full of water in the rainy season. An Indian village named Karto, stands at the north-west corner of the plateau, not far from Mr. Menzies' banaboo. Its provision fields are partly in the tree-clad hills fringing the plateau on the north and partly down in the fertile Kowa Valley, near the point of our crossing, where an extensive area is covered with fruit trees—banana and papaw growing wild. We saw no cattle on the tableland, but the Karto villagers told us that there was a herd on some very attractive-looking pasture-grounds near the head of the Chiung River; for it must be understood that the highlands suitable for grazing are by no means confined to the tableland which we crossed, and from which we could see the savannahs round the upper reaches of the Chiung only a little below our level, while across the valley of the Chiung, lower in its course, we looked up to a yet higher and apparently not less extensive savannah plateau, which Mr. Menzies, to whom it is well known, considers suitable for sheep farming. I may perhaps here suggest that much of the country on the elevated savannahs would be well adapted for growing tea. These attractive and spacious highlands deserve to be developed, and would support a considerable population. They would, as it is, make an admirable hill station. The scenery is beautiful. The climate at the season of our visit was delightful. The locality could be made easily and cheaply accessible from town, and would, I venture to think, prove much superior as a health resort to the West India islands. If however cattle and sheep farms are to be established here, it is very desirable that steps should be taken without delay to put a stop to the pernicious habit, prevalent among both the Mokosis and the Arekunas, of setting the prairies on fire. They do this partly in order to make clearer their trails in the savannahs, where high grass is apt both to conceal the path and to impede progress, partly as a measure of precaution against snake-bite—a somewhat remote danger,

for we only saw two snakes during the whole of our march over the savannahs; partly as a signal of approach; and partly, I believe, merely for the joy of watching a good blaze. The effect of these frequent burnings is to impoverish the land and to facilitate the action of water in eroding the hillsides; but, without doubt, as cattle farming extends in these localities, the aborigines will realize that it is contrary to their own interests thus to devastate their splendid pasture-lands.

GRENADA PRIZE-HOLDINGS COMPETITION.

Increased activity has characterized work connected with the recent prize-holdings competition in Grenada. In June last the Agricultural and Commercial Society approached the Government with the request that Mr. W. M. Malins-Smith, Agricultural Instructor in the Department of Agriculture, might be allowed to do the judging, as the entries on the present occasion of the competition were so numerous that it would not be possible to obtain the services of honorary judges, as heretofore. The proposal of Mr. J. C. Moore, Superintendent of Agriculture, that the cacao holdings in the eastern half of the island should be judged by Mr. Malins-Smith, and the provision garden in the Western half of the island by Mr. W. O'Brien Donovan, Second Agricultural Instructor, was approved by His Excellency the Governor, and the Agricultural and Commercial Society informed accordingly.

The total number of entries was 362, of which 259 were in the cacao section and 103 in the garden section. Of the total, 286 or 79 per cent. became actual competitors and worked. About 60 per cent. of the entries were obtained by Mr. Malins-Smith, who between February and August and prior to the judging, visited all the competitors once, and 190 of them a second time to instruct and encourage them. Departmental visits totalling 735 were therefore made in connexion with the cacao section alone. In the provision garden section Mr. Donovan visited all the competitors once previous to judging, thus, including judging, a total of 195 visits were made.

The new rules which came into operation this year have worked well and their fairness is appreciated by the competitors. The very sound progress reported is distinctly encouraging and must be largely credited to the energetic action on the part of the Agricultural Department.

As to prizes awarded, the total value expended in this connexion in the cacao section was £84 15s., representing the value of fifty-seven prizes; in the case of the gardens £36 was expended representing the value of twelve prizes. The total value of the prizes awarded therefore in this the 1916 competition was £120 15s.

Some interesting correspondence has been appearing in *The Times* (London) on the question of the effect of the export of sulphate of ammonia from England on that country's agriculture. It is maintained that the country's food supply could be considerably increased if more sulphate of ammonia were kept in the country and applied to the soil. It is pointed out however that a large amount of the sulphate exported goes to sugar-producing countries, where it is considered necessary for the successful cultivation of canes, and it is argued that a great deal of the sulphate of ammonia finds its way back to Great Britain, so to speak, in the form of sugar



FUNGUS NOTES.

THE RIND FUNGUS OF SUGAR-CANE.

In Vol. I No. 1 of the *Journal of the Board of Commissioners of Agriculture*, Porto Rico, Mr. J. R. Johnston, formerly pathologist of the Insular Experiment Station, discusses the history and cause of the so-called rind disease. The subject is one which has been exceptionally fruitful in misunderstandings, and the records of old mistakes still confuse issues which in themselves should now be fairly clear.

As to the actual position of the fungus *Melanconium sacchari* in sugar-cane pathology, there is now probably little essential difference of opinion. The account given by Johnston attributes more damage to the action of this fungus than experience in the Lesser Antilles would be held to justify, but this is probably due for the most part to differences in agricultural practice. In some parts of St. Kitts, where owing to the small capacity of the muscovado works cane is often left standing longer than in the general custom in these islands, infestations such as those described by Johnston have several times been noticed. Experience here further coincides with Johnston's conclusions that the fungus occurs on green cane only in shoots injured or killed by *Marasmius* or by insects, and in such circumstances can hardly be considered as more than saprophytic. At a later stage the rotting back of certain varieties is said to be not uncommon in Porto Rico, and is attributed primarily to a weakened condition brought on by poor soil or climatic influences, which leads to infestation with the fungus. The latter, by rotting down the canes to which access is thus opened renders recovery impossible. The conditions are admittedly not clear, and it cannot be said that damage of this type has been definitely recognized by the mycologists of this Department. This may be due to a disposition to regard all such occurrences as due to infestation with red rot (*Colletotrichum falcatum*), with *Melanconium* as a universal scavenger following close behind.

The mention of red rot brings this review to the point where some exception must be taken to Johnston's attitude. After re-traversing the now familiar ground of the synonymy of *Melanconium sacchari* and the confusion introduced into the study of sugar-cane diseases by Massee's ill-considered pronouncements, he criticises somewhat severely the conclusions of Howard in attributing rind disease primarily to *Colletotrichum falcatum*. The point may be at once conceded that rind disease received its name from the appearance caused by *Melanconium sacchari*, and if the name be restricted, as it is by Johnston, to the effects produced by that fungus, then Howard's work mainly concerns a different subject altogether, which is Johnston's contention. He remarks: '[Howard] has selected certain symptoms of disease in the plant ... and has then concluded that the fungus he is dealing with is the cause of the rind disease, disregarding the fact that neither the symptoms nor the fungus have much to do with the rind and have nothing whatever to do with

the eruptions on the rind.' This is little more than a dispute about a popular name. Using the term rind disease at its face value, *Colletotrichum* may have nothing to do with it; using it in its historical sense, it had almost everything. The real starting point of the whole business of rind disease was the occurrence well known and deeply remembered throughout the British West Indies as the breakdown of the Bourbon cane. There were no plant pathologists in the West Indies in those days, and few planters had ever heard of a fungus. The trouble was first attributed to the shot-borer beetle, the association of which with the affected canes was plain to be seen. When the idea of a fungus became more familiar, the presence of *Melanconium* was similarly obvious, and belief in its association with the disease was confirmed by the conclusions of Massee. The terms rind disease and rind fungus were at that stage perfectly appropriate, and were used in reference to the disease, be its cause what it might, which was threatening to wipe the sugar industry out of existence. It is to the work of Howard, applying the discoveries of the Java pathologists to the West Indies, that we owe the recognition of the epidemic as due to the obscure, but potent infestation of the Bourbon with the red rot fungus. The statement that this was the cause of rind disease conveyed an accurate enough meaning to those whom it most concerned. Further, the remark that *Colletotrichum* had 'nothing whatever to do with the eruptions on the rind' will certainly not bear literal interpretation. That fungus was killing out canes by the acre, and every one of these canes, as present experience shows, would become thoroughly infested with *Melanconium*. With the adoption of resistant varieties, shot borer has almost disappeared and *Melanconium* has sunk back to the position outlined in the earlier part of this review, but at that time it must have been almost a prominent object in the landscape.

This reversion to history was necessary in vindication of Howard's usage of the term, but the confusion that its use has continued to cause has led to the very general adoption of the name red rot for *Colletotrichum* disease, and in the publications of this Department the term rind fungus is now restricted, as logic demands, to *Melanconium sacchari*.

W.N.

West Indian Food Supply.—*Nature* for December 7, 1916, the leading English scientific journal, reproduces the principal facts brought forward editorially in the *Agricultural News*, for October 21, on the subject of the effect of the rise in the price of flour upon the local food supply in the West Indies. It is stated: 'The failure of the North American wheat crop this year is causing some anxiety in the West Indies, as the islands rely entirely on this source of supply. It seems doubtful if the usual quantities of flour will be available, and the question of possible substitutes is receiving official attention. The *Agricultural News* (Barbados) of October 21 suggests that the cultivation of maize, Guinea corn, cassava, and sweet potatoes should be extended. All these foodstuffs are already grown in the islands, but in contrast to the important cereals, none of them will keep without special precaution; the sweet potato, the principal vegetable of the people, is particularly perishable. As regards corn, the difficulty can be overcome by drying, and the Governments of Antigua and St. Vincent have established kiln driers working on a co-operative basis. If the shortage of wheat flour should become serious, the rice crop of British Guiana will have to be drawn on to a greater extent than it is already, and the cultivation of this cereal, which is at present a large industry in Trinidad, may be further developed.'

PALM KERNEL CAKE AS FOOD FOR PIGS.

Now available are the results of the important experiments conducted in England under the supervision of the Director of the Institution for Research in Animal Nutrition, Leeds University, in connexion with the value of palm kernel cake and meal as food for pigs. The reader will be aware that there are two important reasons why this article should be fed as much as possible to live stock in Great Britain: first, because there is a large supply of the cake available on account of the transfer of the palm kernel cake market from Germany to England; secondly, because it is necessary to save as far as possible feeding any kind of food to animals which can be consumed by human beings. The experiments in question were carried out on a lot of fifty-four pigs, and covered a period of twenty-four weeks. The meal (oil extracted) and cake were fed against a grade of wheat milling offal known locally as 'thirds' or 'fine sharps'.

It may be stated that the composition of palm kernel cake compares very favourably with that of 'thirds'. Both contain about 17 per cent. of protein, and while palm kernel cake has rather more oil than 'thirds', its percentage of soluble carbohydrates is less. Assuming equal digestibility for the three foods, and using the conventional method of the agricultural chemist for assessing the relative values of feeding stuffs from chemical analysis, it was expected that the 'thirds' would prove slightly superior to the palm kernel cake meal, and a good deal better than the extracted palm kernel meal.

The experiment has demonstrated that palm kernel cake and extracted palm kernel meal can be safely used as foods for pigs in proportions ranging up to almost one-third of the total food supply. With the consumption of equal weights, palm kernel cake produced a rate of gain of live weight almost but not quite equal to that obtained with 'thirds', but the extracted palm kernel meal proved appreciably inferior in this respect. At the prices paid for the foods, the palm kernel cake has proved relatively somewhat cheaper than the 'thirds', but the extracted palm kernel meal has not justified its price. The appearance, flavour and general quality of the meat obtained by the use of the palm kernel foods have proved in every way satisfactory.

Further details concerning this experiment may be obtained by consulting the *Journal of the Board of Agriculture of England and Wales* for December 1916.

Seaweed as a Potassic Manure.—It is now generally recognized in Great Britain (according to the *Journal of the Board of Agriculture* for December 1916), that the most promising of all the present available sources of potash is seaweed, of which there are abundant quantities around the coast of the British Isles. One ton of the fresh seaweed, it is stated, contains as much as $1\frac{1}{2}$ cwt. of kainit. One of the most urgent needs of the present time in Great Britain is to develop this source of potash. Needless to say, the collection and transport of this material involve a good deal of labour at a time when it is more than difficult to secure. In the West Indian islands however, it should be easily possible to make greater use of seaweed as a manure.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets, for the month of December:—

During the first two weeks in December the amount of business in the drug and spice markets was, both in quantities and prices, quite of a satisfactory nature. The tendency in the latter has been, and is still, advancing, but at the period under review, that is at the close of the year, there is always a certain falling off, both in supply and demand, as well as in depreciation of values. The system of buying only sufficient for present needs continues to be the rule and will continue to be so, so long as the war lasts. The following are the chief details in West Indian products.

GINGER.

At the first spice auction on the 6th of the month common to good common Jamaica was quoted at from 80s. to 85s. and 90s. to 105s. for medium to good. A large quantity of washed Cochin was also disposed of, rough fetching 47s. 6d. and wormy 44s. A week later further sales of common to good common Jamaica fetched similar prices to those quoted above, namely 80s. to 85s.

MACE AND NUTMEGS.

At auction on the 13th mace was in good supply, 147 packages of West Indian being offered and sold, fine fetching 2s. to 2s. 1d. per lb., good pale 1s. 10d. to 1s. 11d., fair 1s. 7d. to 1s. 9d., ordinary reddish 1s. 5d. to 1s. 6d., common 1s. 3d. to 1s. 4d., and broken 8d. to $10\frac{1}{2}$ d. per lb. At the same auction nutmegs were also in good supply, 500 packages being offered and sold at steady rates.

SARSAPARILLA.

This drug was in good supply and fair demand at the drug auction on the 14th of the month when 29 packages of grey Jamaica were offered, 14 of which were disposed of at 1s. 10d. per lb. for good grey fibrous; 58 packages of Honduras were also offered and 52 sold, good fetching 1s. 6d. to 1s. 7d. per lb., 1s. 4d. for fair and 1s. 2d. for inferior. Of 8 bales of Lima-Jamaica offered, only 3 were sold, good fetching 1s. 7d. per lb. and chumpy 1s. 6d.; 25 bales of Mexican were also brought forward, but were held at 1s. per lb. Seven bales of native Jamaica were also offered, and were bought in at 1s. for red and yellow mixed.

CITRIC ACID, ARROWROOT, PIMENTO, KOLA AND LIME JUICE.

Citric acid has been firm throughout the month at a stationary price of 2s. 6d. per lb. Arrowroot was in good supply at the beginning of the month at advanced rates, $3\frac{1}{4}$ d. to $3\frac{1}{2}$ d. being paid for good common St. Vincent and $4\frac{1}{2}$ d. for fine. It was reported that as many as 1,000 barrels had been disposed of at the beginning of the month. Pimento was quoted at the beginning of the month at $3\frac{1}{2}$ d. per lb., and at the close it had risen to $3\frac{3}{4}$ d. At auction on the 14th Kola was represented by very large quantities, as many as 234 packages: only 25 however, found buyers, 15 bags of Java fetching 6d. per lb. for fair bright halves, and 10 bags of fair halves from Zanzibar sold at $5\frac{1}{4}$ d. per lb. In the middle of the month it was reported that there were large stocks of lime juice in hand and that good raw West Indian was obtainable at 2s. 9d. per gallon.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
January 11, 1917.

ARROWROOT—3d. to 4½d.
BALATA—No quotations.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, 62/ to 68/-;
Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£45 10s.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 34d. to 36d.
FRUIT—Bananas, £17 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 2/9; concentrated, £22; Otto of limes (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—10d. to 2/-.
PIMENTO—No quotations.
RUBBER—Para, fine hard, 3s. 3¼d.; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., January 30, 1917.

CACAO—Caracas, 15½c. to 15¾c.; Grenada, 14c. to 14½c.; Trinidad, 13¾c. to 14¾c.; Jamaica, 11½c. to 12½c.;
COCO-NUTS—Jamaica and Trinidad selects, \$21.00 to \$22.00; culls, \$12.00 to \$13.00.
COFFEE—Jamaica, 10c. to 12c. per lb.
GINGER—15c. to 18c. per lb.
GOAT SKINS—Jamaica, \$1.25; Antigua and Barbados, \$1.15 to \$1.25; St. Thomas and St. Kitts, \$1.00 to \$1.15 per lb.
GRAPE FRUIT—Jamaica, \$1.00 to \$1.50.
LIMES—\$5.00.
MACE—43c. to 49c. per lb.
NUTMEGS—20c. to 24c.
ORANGES—\$1.25 to \$1.75.
PIMENTO—5¾c. per lb.
SUGAR—Centrifugals, 96°, 4.89c; Muscovados, 89°, 4.28c.; Molasses, 89°, 3.89c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., January 26, 1917.

CACAO—Venezuelan, \$14.25 to \$14.50; Trinidad, \$13.25 to \$13.75.
COCO-NUT OIL—\$1.30 per Imperial gallon.
COFFEE—Venezuelan, 14½c. to 15c.
COPRA—\$7.00 per 100 lb.
DHAL—\$6.75.
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$7.40 to \$7.75; White, \$8.00 per bag.
SUGAR—American crushed, no quotations.

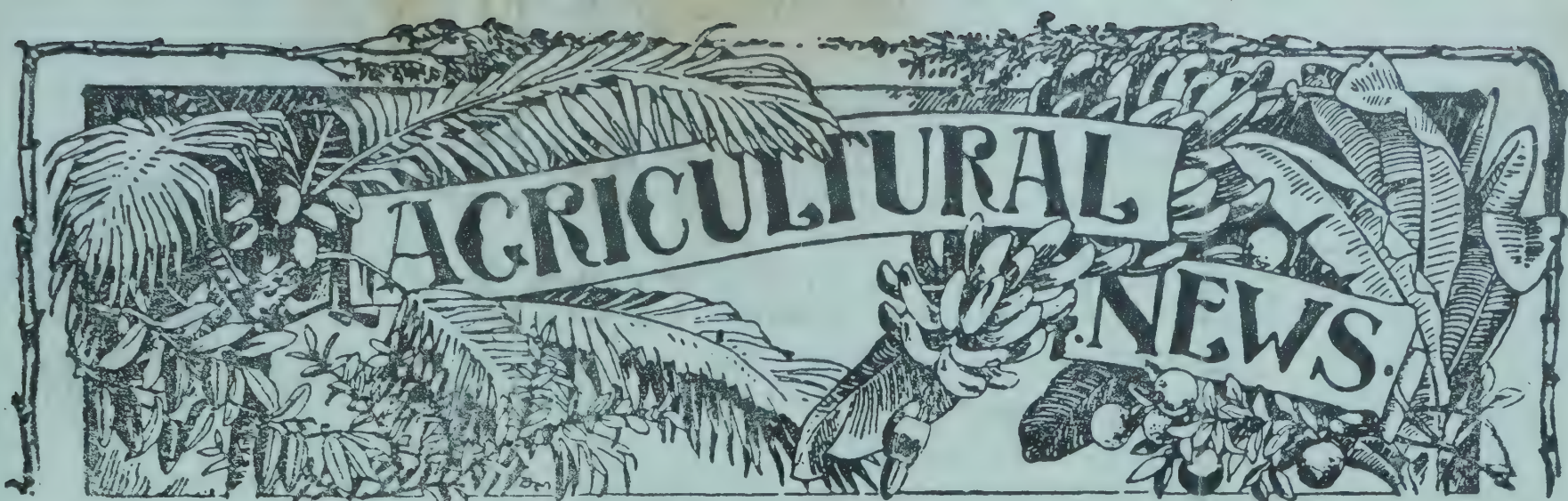
Barbados.—Messrs. T. S. GARRAWAY & Co., February 6, 1917.

ARROWROOT—\$5.00 per 100 lb.
CACAO—\$11.50 to \$12.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, \$112.00 per ton.
MOLASSES—No quotations.
ONIONS—\$10.00.
PEAS, SPLIT—No quotations; Canada, \$6.00 per 120 lb.
POTATOES—Nova Scotia, \$6.00.
RICE—Ballam, \$8.55; Patna, no quotations; Rangoon no quotations.
SUGAR—Muscovado centrifugals, \$4.50.

British Guiana.—Messrs. WIETING & RICHTER, December 30, 1916; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	\$11.00	
BALATA—Venezuela block		
Demerara sheet	\$65.00	
CACAO—Native	16c. per lb.	
CASSAVA—	84c.	
CASSAVA STARCH—	\$9.00	
COCO-NUTS—	\$20 to \$24 per M.	
COFFEE—Creole	12c. to 13c.	
Jamaica and Rio	15c. per lb.	
Liberian	11c.	
DHAL—	\$6.50 to \$8.00	
Green Dhal		
EDDOES—	96c.	
MOLASSES—Yellow	None	
ONIONS—Teneriffe		
Madeira	7c. to 8c.	
PEAS—Split	\$12.00 to \$12.50	
Marseilles		
PLANTAINS—	32c. to 60c.	
POTATOES—Nova Scotia	\$5.25 to \$5.50	
Lisbon		
POTATOES—Sweet, B'bados	\$1.92	
RICE—Ballam	\$7.00	
Creole		
TANNIAS—	\$2.88	
YAMS—White	\$2.40	
Buck		
SUGAR—Dark crystals	\$3.40 to \$4.50	
Yellow	\$5.00 to \$5.10	
White	\$7.00	
Molasses		
TIMBER—GREENHEART	48c. to 72c. per cub. foot	
Wallaba shingles	\$5.50 to \$7.50 per M.	
„ Cordwood	\$3.00 to \$4.00 per ton	

NO QUOTATIONS.



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The Growth of the Smaller West Indian Departments of Agriculture.

THE Reports issued on the Agricultural Departments of the Windward and Leeward Islands continue each year to improve. Those which have just been published, relating to work conducted during 1915-16, attain to such a high standard of value and interest that we are prompted to place on record a brief account of the activities to

which they refer, and of the remarkable progress that has led up to the present satisfactory state of affairs.

It must be realized that what we now call Agricultural Departments in these islands began, in most cases, as Botanic Stations, consisting principally of ornamental gardens and plant nurseries. The modern Department is an institution possessing external functions as well as those of an internal character. A modern Department is more than an Experiment Station, though it carries on experiment station work. It is, in fact, an institution for investigation, for the provision and control of planting material, for the dissemination of information and advice, for the introduction of new industries, and for the organization of agricultural communities, particularly in regard to the small land-owner. Its functions are therefore of a very varied and far-reaching character. Naturally the amount and standard of work that can be done is limited by the extent of the *personnel* and equipment. Thus the larger tropical colonies like British Guiana, Ceylon, and Mauritius possess a staff of experts and adequate equipment in the way of laboratories and experimental farms to allow of the conduct of extensive investigations. An enormous institution like the United States Department of Agriculture necessitates subdivision into Bureaus, working in conjunction with the State Experiment Stations, each of which is able to carry on scientific studies as well as the investigation of problems immediately relating to agricultural practice.

Thus we find all grades of Departments of Agriculture, from those staffed by one or two officers, to those which employ many hundreds. But the relative size of a Department does not necessarily determine its efficiency. A small Department in a small place can do effective work as well as a large Department in a bigger country. The chief handicap to a small

department, particularly in an island, is its isolation, and its inability to employ scientific experts. This trouble has been got over to a large extent in the islands of the Windward and Leeward groups of the West Indies, through the existence of the Imperial Department of Agriculture.

The striking fact to be recorded is that the Reports to which we have previously alluded clearly demonstrate that the agricultural establishments in the smaller West Indian islands have grown out of the narrow Botanic Station atmosphere into the wider atmosphere of Departmental activity.

Reference to the reports of earlier years will at once make this manifest. Indeed it is hardly necessary to go back more than five or six years to detect a distinct transformation.

Reviewing the course of events in the different colonies, we note, first of all, several marked developments in Grenada. Previous to 1905, agricultural work consisted principally in the raising and distribution of plants. On the appointment of Mr. R. D. Anstead as Superintendent of Agriculture, the work became of a broader character, but no definite attempt to organize a Department was made until 1910 when Mr. G. G. Auchinleck succeeded to the office. The Department at the present time, under the direction of Mr. J. C. Moore, is associated with several well defined and important lines of activity. Work in the nurseries is more active than it has ever been in the past, chiefly on account of the increased demand for lime plants. The work of the Department in regard to peasant instruction has been very considerably extended, and prize-holding schemes have been conducted. While the chemical and other scientific investigation work started by Mr. Auchinleck is for the present in abeyance, useful work continues to be carried on in regard to the control of pests and diseases, and in the matter of plot experiments with different crops of economic importance. A scheme of agricultural education for cadets has also been adopted by the Department.

In St. Vincent, the development of departmental work has been very pronounced. It would be impossible in the space available even to refer to all the various lines of activity that have arisen during the last fifteen years. Reference, however, may be made to Mr. W. N. Sands's work in connexion with cotton selection and the cotton industry generally. More noteworthy perhaps has been the work of the Department in regard to land settlement and peasant instruction. In this Colony systems for facilitating the sale of cotton and corn have been instituted for the benefit of the

peasant, and credit societies have been formed in some districts under the auspices of the Government. During the last year or two, scientific work of a valuable character was started by Mr. S. C. Harland, the Assistant Superintendent, and this work is becoming widely recognized. Selection and manurial experiments with cotton have been placed upon a scientific basis, and important entomological results have also been obtained. The Department is at present conducting a vigorous campaign, under a special Ordinance, to eradicate the cotton stainer by means of the destruction of its native food-plants.

Agricultural affairs in the neighbouring colony of St. Lucia have undergone notable changes too, within the last few years. In 1913 a new Botanic and Experimental Station was established at Choiseul, on an estate especially bought for the purpose by the Government. Part of the estate has been converted into a land settlement. Considerable credit is due to Mr. A. J. Brooks the Agricultural Superintendent, for successfully carrying out this scheme. To assist the small lime grower, the Government in 1913 established a model lime juice factory which was successfully put in operation by Mr. J. C. Moore, and has not only proved itself of great benefit to the growers but a source of revenue to the Government. Much attention is now being given in St. Lucia to the encouragement of minor industries, to the settlement of Crown lands, to the provision of agricultural credit and of agricultural instruction.

In Dominica, the work of the Department has extended very considerably in recent years. Formerly the agricultural establishment consisted principally of the Botanic Gardens and plant nurseries. Now special cacao and lime experiment stations have been formed, a chemical laboratory has been established, and the activities of the Department extended in several directions. A considerable amount of useful work has been done in regard to methods of plant propagation, such as grafting and budding, and, in conjunction with the Imperial Department of Agriculture, the more destructive diseases of orchard trees have been successfully brought under control. Manurial experiments with cacao have been carried on for many years. Other activities include an excellent system of agricultural education at the Gardens, and frequent visits to estates in the country. The report recently prepared by Mr. Joseph Jones, the Curator and Superintendent, and his Assistant and Chemist Mr. G. A. Jones, clearly testifies to the valuable and varied character of the work of this Department.

Notable progress is to be recorded in the case of the next island, Montserrat, where Mr. W. Robson has

been in charge of the Experiment Station for many years. Mr. Robson's work on cotton selection is fully recognized by the planters of this island, and is regarded as fundamental to the staple industry of the Presidency. Of recent years special attention has been given to the cultivation of the Bay tree, and to investigations concerning the yield of oil from the leaves of this tree. Progressive work has been done in connexion with the control of pests and diseases. Quite recently an Onion Growers' Association has been formed, which introduces the commercial element into the Department's work, as does also the experimental shipment of fruit and vegetables to Canada.

Coming to Antigua, we find the most unique instances of progress in Departmental activity. Antigua being the seat of the Federal Government for the Leeward Islands, has for a long time possessed a more fully equipped agricultural establishment, but it began originally in a very small way. The most important event in the economic history of Antigua was the establishment of Gunthorpes Central Sugar Factory in 1905. This was brought about largely through the Federal Department of Agriculture, to which the present Imperial Commissioner of Agriculture for the West Indies was then Superintendent and Analytical Chemist. The experimental work of the Department has for nearly twenty years now, included the well-known variety and manurial tests with sugar-cane. Additional to this, a large number of original chemical investigations have been conducted at the Federal laboratory, papers on which have been published in the *West Indian Bulletin*.

During the last two or three years, a marked trend in the direction of co-operative action has been introduced by the Antigua Department. This is shown in the establishment of an Onion Growers' Association and a Cotton and Lime Growers' Association. Recently also, the Government authorized the erection of a Granary for drying and storing Indian corn. This is managed by the Department, as are also, to a large extent, the affairs of the Associations referred to above. Added to these economic activities, Mr. T. Jackson, the local Superintendent, has charge of the routine work at the Experiment Stations, where plot experiments are conducted with cotton, provision crops and other economic plants. At the present time many minor investigations are in progress which may have important economic results: for instance, trials of fibre plants and reforestation experiments.

For the last eight years the office of Superintendent of Agriculture and Government Chemist for the

Leeward Islands has been held by Dr. H. A. Tempany, recently promoted to Mauritius. To him much of the progress and development made during that period in Antigua has been due, while his advice, and assistance in investigation matters, have been invaluable in other Presidencies of the Colony.

The remaining islands of agricultural importance are St. Kitts-Nevis, Anguilla, and the Virgin Islands.

On account of the established character of St. Kitts, there has not been scope within recent years for the extension of much departmental activity in that island. Mr. F. R. Shepherd's work with cotton, however, has become more and more important, while the experiments with sugar-cane have been carefully continued. The establishment of a central factory in 1911 has had an indirect effect in widening the work of the Department, while the establishment of a Government laboratory in 1913 for agricultural investigations has had a direct influence.

Some noticeable changes have taken place in Nevis, where Mr. Shepherd, and Mr. W. I. Howell the Agricultural Instructor, have been giving increased attention to agricultural matters in this island. The cultivation of cotton by the peasants has shown an improvement, and at the present time active steps are being taken to establish an onion-growing industry. The Department is conducting an important series of manurial experiments with coco-nuts on an estate in this island, and in due course the results will be of great interest not merely locally, but in other parts of the tropics.

Agricultural work in the Virgin Islands is in the hands of Mr. W. C. Fishlock. Tortola and the surrounding islands have suffered a serious set-back this last year through the visitation of a severe hurricane, and the experimental work has been seriously interrupted. Previously, however, even in such a small community as that of Tortola, much has been done to further the agricultural interests of the island of recent years. Cotton selection has been started and coco-nut demonstration plots established. Plot experiments have also been carried out with provision and other crops. As in Nevis, so here, successful efforts have been made to extend the cultivation of onions. A system of purchasing cotton and limes from the peasants has been in operation for a considerable time, and has proved of great benefit to the people.

The foregoing will afford some idea of the stages of development reached by the Agricultural Depart-

ments in the Windward and Leeward Islands. In forming an appreciation of the standard and variety of the work, the fact should be taken into account that in most of the islands the staff of each Department consists of only one, two, or at most, three responsible officers whose multitudinous duties allow of but little specialization on any particular subject.

In spite of this, a very satisfactory all-round development has taken place. This appears to be exceptionally creditable when one considers that the expenditure of money on each Department to-day is, with one or two exceptions, no greater than it ever was. The amount expended on each establishment varies from about £1,000 to £1,500 annually. This is certainly not extravagant when one compares the amount and value of the present work done with that performed on the same expenditure some ten or fifteen years ago; or with the work performed by Departments in larger colonies where the expenditure is many times greater.

SUPPOSED DETERIORATION OF VEGETABLE SEED IN THE TROPICS, AND SUGGESTIONS FOR SEED PRESERVATION.

Bulletin No. 20 recently issued by the Porto Rico Experiment Station on the above subject is of immediate interest to the British West Indies. It is the common belief in the islands that vegetable seed when grown through several generations in the tropics tends to deteriorate. Difficulty is also experienced in storing vegetable seed without loss of germination power. This is particularly so in the case of onion seed. The Bulletin states:—

That northern vegetables degenerate quickly when taken to the tropics is a common belief in Porto Rico, resulting from the fact that seed loses its viability quickly when exposed to moist air, and from a lack of knowledge regarding seasonal effect on vegetable production.

To retain the viability of seed of the crops used in the experiments here reported, the seed was stored in air-tight jars in the bottom of which was placed a small quantity of calcium chlorid. This method was so satisfactory that it is recommended for general use.

Planting a few types of peppers, such as are commonly grown in Porto Rico, side by side with varieties imported from the North, showed that the Porto Rican types are much more productive and therefore more desirable than imported varieties.

Forty plantings of beans were made, including nine generations. Of the Porto Rico plantings those made in March gave large crops, except one in 1911, which was hindered by an exceptional drought; while those made in other months, including June, September, November, December, and January, gave small harvests. No indications that

advanced generations were inferior to earlier ones were observed.

Records of the five years' work with okra, during which time thirty-two plantings were made, reaching finally the eighth generation, show that the growth and production of the advanced generations are not inferior to those of the earlier ones.

The development of plants of the different generations of tomatoes grown in Porto Rico was very uniform and proves that, except for occasional importations, the seed of this vegetable needed in Porto Rico can well be grown in the home gardens.

In the work with lettuce no degeneration was noted as a result of growing an imported variety for successive generations in Porto Rico. Owing to the difficulty of producing seed during seasons of heavy rain, the experiments with this crop were hindered considerably. As seed production is difficult and loss of viability rapid, it will probably be necessary to import the seed of this crop.

In all vegetable plantings, the season at which the planting was made had a very pronounced effect on the yield, being the predominant factor influencing production.

East Indian Immigration—Six hundred and thirty-eight Indians were despatched to Trinidad in October. There were among them 181 women. At present, contrary to former experience, women are more easily obtainable than men, and there will be great difficulty in obtaining full complements of coolies. This is largely owing to the government recruiting of coolies for war work in Mesopotamia. Jamaica proposes to import about 900 Indians next season. But while Jamaica is importing East Indians, there is a rush of her own men to Cuba. It is calculated that there are some 40,000 Jamaicans at work in the neighbouring foreign countries. In Cuba they get 4s. a day on the sugar estates, while the most favourable wage proposed for East Indians is 1s. No doubt, in such places as Cuba, the money does not go as far as in Jamaica, but the high figure is an irresistible attraction. If Jamaica could organize a sugar industry on Cuban lines, the labour might be kept at home. A Committee in the island is discussing the question. (*Colonial Journal*, Vol. X, No. 3, January 1917.)

Prosperity of the Falkland Islands.—The Falkland Islands, besides figuring as the scene of our greatest naval engagement in this war, have some remarkable commercial features. The excess of exports over imports—in 1915 the respective values were £1,576,126 and £368,272—is phenomenal. Wool and whale oil in these times are very valuable commodities. Other colonies have had to put up with the scarcity of shipping, but in the Falkland Islands there has been an increase. The exports, for a population of 3,451, also show a phenomenal production per head. Another noteworthy point is that a proclamation was issued, on account of the war, to the effect that all goods exported should go to the United Kingdom. One result of the position is that the islands may fairly be called the paradise of manual labour. Skilled labourers get 1s. 1½d. an hour, with 1s. 8d. overtime, and in many cases free housing. There is no good of any workhouse, and though a gaol is provided, it is generally empty except for the accommodation of an occasional erring sailor from a ship in the harbour. There is a great lack of ordinary comforts and conveniences in the houses, but as there is plenty of money, these deficiencies will no doubt be lessened in time. (*Colonial Journal*, Vol. X, No. 3, January 1917.)



THE HAWAIIAN SUGAR CROP OF 1916.

The United States Department of Agriculture, under date of January 4, has given some details of the Hawaiian sugar crop for 1916, from which the *Louisiana Planter* secures the following data:—

The crop year was considered to end on September 30. While the plant cane in Hawaii requires about eighteen months to mature, yet its planting and harvesting are so adjusted as to come within the limits of the crop years ending September 30, as above noted, and the basis for the consideration of the total crops produced are estimated by the calendar years. There has been some objection made to this at times by some of the Hawaiian planters, they holding that their sugar crops were more expensive to produce owing to the longer time involved from the date of planting to the date of harvesting. The interest on the investment in the land would be about the only additional cost, and the annual production is properly comparable with the annual production of any other sugar-producing country.

As now reported, the crop for the year 1916 amounted to 529,253 long tons, or about 47,533 tons less than the year before, or a falling off of about 9 per cent. The area harvested was 115,419 acres or 2,219 acres more than the previous year. But with a lower yield of cane per acre and a smaller average of sugar per ton, the shortage in the crop resulted. The total area in cane in 1916 is reported at 246,332 acres, an increase of 6,532 acres over the report of the previous year. Of the total cane area, 115,419 acres as hereinbefore stated, were harvested or, say, 47 per cent., and the remainder 130,913 acres was left over for grinding within the following calendar year.

Some additional interesting data are also given. Of the area harvested during the last five years there has been rather an exceptional uniformity, the lowest report being 112,700 acres in 1914 as against 115,419 acres harvested in 1916, the rest of the five years being intermediate. The average yield of sugar-cane per acre was 42 short tons for 1916, 46 tons for 1915, 45 tons for 1914, 39 tons for 1913, and 42 tons for 1912. The yield of sugar per short ton of cane, our common way of estimating it in Louisiana, was down to 240 lb. per ton in 1914, and as high as 249 lb. in 1912, the whole, as will be seen, varying within the limits of from 12 to 12½ per cent. yield in sugar of the weight of the cane. The lengths of the campaign varied from 200 days in 1912 to 169 days in 1913, the other years intervening within these limits. The comment is made that the figures for 1916 are subject to revision.

The same Journal for January 20, refers to the high sugar extraction in Hawaii where a 97 per cent. recovery is obtained. Commenting on the fact, the Journal says:—

We are confident in our belief that the day is not far distant when the trial of high extraction, already blazed in Hawaii, will be followed to the end in Cuba and in the other more progressive cane-growing countries in the world. And we can see no reason to doubt that shredders and pre-crushers—possibly a combination of the two—with a generous use of water, will do just as good work in other countries as in these where they were first developed.

LIME AND ARROWROOT CULTIVATION IN BRITISH EAST AFRICA.

The prospect of eventually establishing a lime industry in the Protectorate of British East Africa has been kept in view for some years past, and data have been collected in that country which prove that the lime tree will flourish and produce good crops over a wide range of British East Africa. According to the Chief of the Economic Plants Division of the Department of Agriculture, writing in the Annual Departmental Report for 1914-15, it is desirable that the coffee planters in the Uplands should have a reliable permanent second cultivation to fall back upon in case the coffee leaf disease should later assume serious proportions; and taking into account the satisfactory manner in which citrus fruits thrive in the coffee districts, the establishment of a lime industry and the more extended cultivation of other citrus plants are regarded worthy of careful consideration.

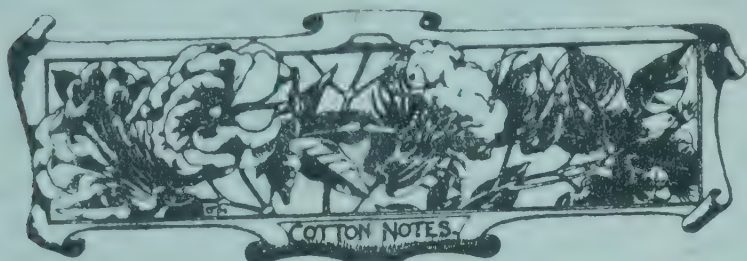
In looking through the rainfall records for British East Africa, we notice that the precipitation in many districts is much below the requirements of lime cultivation, and unless the plantations are thoroughly well sheltered by wind-breaks to maintain a humid atmosphere, it is difficult to understand how the trees manage to flourish. Whereas citrus trees like the orange and grape fruit are not very particular as regards environment, the lime tree in order to flourish requires very special conditions. However, it is stated in the report that the Dominica lime trees at Mazeras are growing and fruiting splendidly, and that batches of seedlings are being raised there in case a demand should arise for them. We notice that in the rainfall records, the total precipitation at this place is only about 30 inches. The report also states that fruiting Dominica lime trees are established and thriving at the Kibos experimental farm. The rainfall at this station in 1914 was only 41.14 inches.

Turning to the cultivation of arrowroot, the report says that certain selected parts of the Protectorate are considered by the Department of Agriculture to be suitable, and land has been taken up experimentally on a small scale by one or two settlers in the Highlands. It appears that the depression in the arrowroot market during 1914 caused planters to hold back, and mention is made of the fact that there has been a tendency for the same reason to plant other crops instead of arrowroot in St. Vincent.

Planting Cassava on Banked and Unbanked Land.—It is stated in the Report on the Agricultural Department, St. Vincent, 1915-16, that this experiment, started the previous year, was continued. The results are shown below in tabular form:—

Designation of plot.	Size of plot.	Yield per acre in lb.
A. Banked 5 feet × 2 feet.	$\frac{1}{10}$ -acre	20,948
B. Unbanked 5 feet × 2 feet.	$\frac{1}{10}$ -acre	22,525

From the above figures it will be seen that there is a difference of 1,577 lb. per acre in favour of the unbanked method of planting, or 7.5 per cent. Comparing the results with those of 1913-14 and 1914-15, we see that in 1913-14 there was a difference in favour of the unbanked method of 25.1 per cent., and in 1914-15 of 5.1 per cent. Thus, in spite of the absence of an adequate number of control plots, it is fairly certain that an advantage is likely to be gained by planting cassava on the flat rather than on banks.



COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ending February 3, 1917, is as follows:—

ISLANDS. There continues an absence of demand, consequently the market is dull and nominally unchanged.

The unsettled condition of the trade generally renders holders of cotton somewhat anxious, and there is more disposition to sell; consequently, with orders in hand at 1c. to 2c. below the following quotations, it is likely orders could be executed.

We quote viz:—

Fully Fine	53c. = 55c.	landed.
Fine	50c. = 52c.	„
Fine, slightly off	48c. = 50c.	„

GEORGIAS AND FLORIDAS. Notwithstanding the demoralized condition of the Upland market in consequence of the war news, resulting in an unprecedented decline, there is a good deal of inquiry for Extra Choice to Fancy Georgias, with some orders seeking execution on account of the Northern Mills, on a basis of Fancy 48c., at which some small lots have been sold. This demand is apparently caused by the difficulty of getting Egyptian cotton, and the impression is that the buying will become more general. Although Factors are holding 1c. higher, we can buy occasionally at the following quotations, viz:—

GEORGIAS AND FLORIDAS.

Extra Choice to Fancy	48½c. = 50c.	landed.
Extra Choice	48c. = 49½c.	„
Choice	47c. = 48½c.	„

The exports from Savannah for the week were, to Northern Mills, 1,129 bales, Southern Mills, 100 bales, and from Jacksonville to Northern Mills, 167 bales.

Labour Conditions in Porto Rico.—The *Louisiana Planter* for February 3 publishes the following note concerning labour trouble in Port Rico:—

Although sugar men in general in Porto Rico had not anticipated any labour troubles during the present grinding season such as have been the case for the past two or three years, it has now been announced by Santiago Iglesias, the leader of the Federation of Labour of Porto Rico, that unless a minimum wage of one dollar a day and an eight-hour working day are granted by the centrals before February, here will be a general strike of sugar-cane labourers.

TRADE AND AGRICULTURE OF JAMAICA, 1915-16.

The Report on the Blue Book of Jamaica for the year 1915-16, is issued as a supplement to the *Jamaica Gazette* of December 28, 1916.

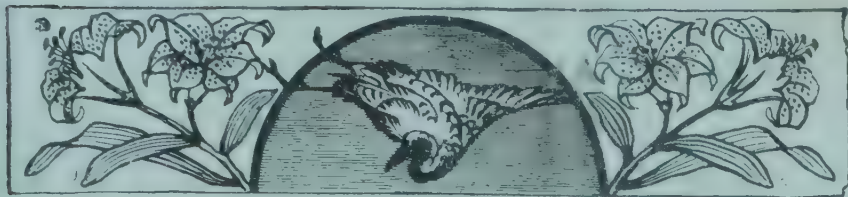
The total values of imports and exports for the year were, respectively, £2,327,458 and £2,228,664. This is a decrease on the imports and exports for the year 1914, the similar figures in the latter case being £2,565,820 and £2,904,533, respectively. The most direct cause of the decrease in imports in 1915-16 was the shortage of tonnage brought about by the European war; in the case of the exports, the importance of this factor is probably reversed, as to the scarcity of fruit is to be attributed the greater portion of the decline in the value of exports, comparison with 1914 showing a falling off on this item alone of £708,982. Against this falling off, however, due in great part to the effects of the hurricanes experienced in August and September, there was an increase in the output of the products of the sugar-cane of £220,362; in dye-wood and extract of £131,758; cacao, £77,058; lime juice, £12,690; and annatto, £6,851.

As regards agriculture, the year was one of favourable seasons, and but for the hurricanes and storms in August and September, already referred to, very large crops would have been obtained. The banana industry suffered severely from the hurricane, while the scarcity of ships occasioned anxiety as to the immediate prospects of the fruit trade. The exports of cacao showed a gain of one-third in value over the previous year, which were the greatest on record. The demand by the public for plants of all sorts was brisk, and the various nurseries, despite retrenchment in their upkeep, established a record in the distribution of plants for the year, 127,000 cacao plants alone being issued to the public.

The sugar industry enjoyed a successful revival, and owing to the high values now ruling for both sugar and rum, the planters have realized a large sum for their produce, and are hopeful as to the future. A good deal of planting of sugar-cane has been undertaken, and schemes for the extension of sugar enterprises are being actively pursued. While the storms damaged the coco-nut trees somewhat, the actual loss of palms was small, and the trade in coco-nuts has been both brisk and profitable. Some 600 tons of copra were exported during the year, and this would appear to be a new industry that will figure more largely in the exports of the Colony in the future. Owing to the blockade of Germany, logwood has been in strong demand, and high prices have ruled for wood both for export and for use in the local dye factories.

The Government Stock Farm at Hope has had a successful year. The attendance at the Farm School has fallen off slightly, due to war conditions. It had been decided by the end of the year to convert the station at Lititz into a sisal hemp plantation, as the land proved to be suitable for stock rearing or general cultivation. Preparations for planting about 600 acres in sisal and henequen have been made at this station.

Tilled lands in 1915-16 comprised 278,262 acres, as compared with 271,382 acres for the period 1911-15. Lands subject to tillage are further classified under the particular crops which they produce; the following figures give the acreage under each classification for 1915-16: canes 33,830 acres, coffee 18,383, coco-nuts 30,072, banana 89,477, cacao 11,432, ground provisions 64,082, mixed cultivation 28,103, and minor items 2,883 acres.



VALUE OF RICE AS HUMAN FOOD.

Much attention has been given at the Research Institute at Pusa, India, to the chemical composition of different kinds of rice. According to the Report on the Institute for 1915-16, the composition of the rices did not vary much, but the analytical figures allow an interesting deduction. The Report states:—

The amounts of oil, fibre and ash vary between very narrow limits, and the sum of these constituents will be more or less constant. The sum total of the remaining constituents of albuminoids and soluble carbohydrates is thus also constant. It was found that the sum of the percentage figures for albuminoids and soluble carbohydrates, in all instances except three, fell between 94 and 95. In these three latter cases the figures were 93.9 and 95.3. But the deviation is so small that the general observation may be said to hold good in these instances also. It was thus noted that when the amount of albuminoids was high, the carbohydrate content was low, and vice versa.

The amount of phosphoric acid is always very slightly less than half of the total mineral matter present. Potash is, again, very nearly half of the amount of phosphoric acid present.

The effect of polishing is next dealt with, and it is pointed out that polished rice becomes poorer in all constituents except soluble carbohydrates, which increase a little.

RICE AS AN ARTICLE OF DIET.

It might be supposed that the estimation in which any variety of rice is held among the consumers, as evidenced by its market price, would be mainly determined by its nutritive value and its palatability. The latter term includes culinary properties, such as flavour, consistence, appearance, taste, etc., which cannot be definitely described, and are rather difficult to observe accurately.

As regards the nutritive value of rice, as revealed by analysis, there is no doubt that, other things being equal, the variety of rice which contains larger amounts of albuminoids is more valuable, inasmuch as albuminoids, which are the flesh-formers, are a more expensive form of food than starch. The relative nutritive value of a sample of rice can thus be assumed to depend on its albuminoid content. It was noticed, however, that no accurate relation can be found between the chemical composition and the value of a rice from the consumer's point of view.

In a well-balanced ration, the relations between the albuminoids, the oil and the soluble carbohydrates should vary within certain definite limits. Rice, however, in common with other cereals, contains an extensive proportion of starch, and is thus not suitable for use as the sole article of diet by anyone.

This holds not only from the point of view of the organic constituents but also of the mineral ones, which are the bone-formers. Rice is quite poor in this respect also. The importance of giving due consideration to the amount and composition of the ash of foods is very great, in order to

ensure the supply of material for the proper development of bone, and of the mineral constituents necessary for vital processes—factors which have as much influence on the well-being of animals as proteids, carbohydrates and fats in appropriate quantities.

Where a variety of foodstuff is used, the probability of much injury being done by ignoring these aspects of the question is not very great. Happily the use of rice is nearly always supplemented by the addition of other substances of vegetable and animal origin, which often supply the deficient elements.

An interesting characteristic of rice protein may be mentioned here. It has recently been shown that in its general aminoacid make-up, the protein of rice more nearly resembles the majority of the proteins of animal tissues than do the proteins of maize and wheat. This may explain the fact that rice, in spite of its low protein content, furnishes food for more human beings than any other cereal.

FERMENTATION OF SISAL WASTE.

The increased attention that is being given to sisal cultivation in some parts of the West Indies makes the following note, taken from the Annual Report of the Department of Agriculture, British East Africa (1914-15), of some local interest:—

Experiments on the fermentation of sisal waste were continued this year, but no very great progress was made owing to lack of time and opportunity to carry out such research work.

The results, however, confirmed those previously obtained. A preliminary analysis of the juice of leaves from the Coast gave just about the same value for the sugar content as was obtained for the Highland material, namely, not more than 3.0 per cent.

In Yukatan, where sisal waste has been fermented with success, and alcohol from such has been put on the market (according to report), the sugar content never went below 9.4 per cent., and at the end of their long dry season is stated to have reached as much as 14.1 per cent. Most of the alcohol was produced from leaves containing, on the average, 12 per cent. sugar.

As stated in last year's report, a yeast was isolated from sisal plants which fermented a glucose solution, but which was quickly killed in the sisal extract. This was no doubt due to the action of organic acids in the extract which were present in great quantities.

On neutralization with sodium carbonate and the addition of a small quantity of glucose, it was found possible for the yeast to live in the sisal extract; but no fermentation was induced.

Further work on more exhaustive analysis, and on the neutralization and destruction of the organic acids was not completed owing to the Analyst, for want of time, being unable to carry out experiments of this nature.

The work of discovering and isolating further yeast ceased, owing to other pressing work.

It would be of great interest to continue the work, for the Analyst was by no means certain that the 3 per cent. represented the whole of the sugars contained in the sisal juice. Moreover, the organic acids present might prove of importance (oxalic acid, for example, if found to be present in any quantity).

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue reviews in a general way the development and present activities of the smaller West Indian Departments of Agriculture.

An interesting article on the supposed deterioration of vegetable seeds in the tropics appears on page 68.

Under Plant Diseases, three important notes will be found, concerning a disease of pigeon peas, citrus canker, and poisoning of a coco-nut palm, respectively.

The present importance of food crops lends special interest to Insect Notes in this issue, which deal with the scarabee and other pests of the sweet potato, on page 74.

Farm Machinery now Classed as 'Munitions' in Great Britain.

In connexion with the increased production of home-grown food, the British Government is taking very definite and active steps. The following announcement appears in the *Times* for January 10:—

The Ministry of Munitions announces that an Agricultural Machinery Branch has been set up in conjunction with the Board of Agriculture and the Food Controller to deal with the control of the manufacture of agricultural machinery and implements. It is intended to class the manufacture of all such machinery and implements as munitions work.

Mr. S. F. Edge has lent his services to the Ministry of Munitions as Director of this Branch, and Mr. E. Guy Ridpath is Deputy Director.

An Advisory Committee of representatives of the agricultural machinery trade generally to advise the Branch has been established.

What is a Luxury?

The restriction in the imports of certain materials into Great Britain on account of the shortage of freight may affect the West Indies. The restrictions will concern principally the so-called luxuries. These include first of all, many of those commodities that are used in the confectionery and perfumery trades—sugar, cacao, essential oils and spices—possibly also alcohol and tobacco. In fact, restrictions will be put on the shipment of all classes of commodities which are not essential to the conduct of the war, if conditions make doing so necessary or even desirable.

As to what constitutes a luxury, is not easy to decide in times of peace; but under present war conditions, a luxury is a thing which is not necessary for the maintenance of national efficiency or for the successful conduct of the war.

The *Perfumery and Essential oil Record* for January maintains that perfumery is not a luxury. The chief object of the article published therein is to try and protect the trade. Reference is justly made to the medicinal value of Eau de Cologne, and to certain essential oils or their products, which are useful in the treatment of wounds. But we cannot agree that the use of perfume is essential to national efficiency or even to comfort. The statements that 'In some ports, such as Colombo and Singapore, the white man can hardly sleep or take a meal in some hotels unless he or someone else uses perfumery', and that 'travellers in Central and South America would often rather miss the menu than their perfume' cannot be taken seriously. Most travellers in the West Indies and South America would sooner miss the menu than stand the perfume. At the same time one has to look at the matter from a trade point of view, and remember the large amount of capital invested in the perfumery business. The export trade alone from Great Britain is very great; even a small place like Barbados imports perfumery to the value of some £3,500 annually, though it is true that more than half of this comes from the United States and the Danish West Indies.

Interest in West Indian Agriculture.

Personal interests vary so much in the West Indies, and the agricultural conditions in the islands are so essentially different, that the task of editing a fortnightly journal of agricultural information so as to appeal to all classes of readers is beset with many difficulties.

Nevertheless, evidence indicating that the information recorded in these pages is not lacking in general interest nor devoid of an instructive character, is seen in the extent to which other tropical journals refer to, or reproduce information appearing in, the *Agricultural News*. Recently the *Tropical Agriculturist* of Ceylon reproduced in the December issue, six different articles emanating from this Office, including an editorial; in fact the interest taken in West Indian affairs in other parts of the tropics is general, and it would be a good thing for the West Indies if each island also tried to be a little less self-centred and followed events more closely in neighbouring colonies, as well as in the tropics generally.

Growth of the Agricultural Departments.

An attempt has been made editorially in this issue to give an outline of the development and present activities of the smaller West Indian Departments of Agriculture. The article will probably be read with a considerable amount of interest, and also, we trust, with some satisfaction. In dealing with so wide a range of activities in the limited space of a single article, it becomes impossible to refer to every line of work in the various establishments; but it is hoped that the selected references that have been made give a fair impression of the work, both from a local and general West Indian stand-point. Detailed accounts of the work of the Departments can be seen by reference to the Annual Reports, where specific mention is made of the valuable activities of the junior officers of the several establishments.

Remarkable Growth of a Banana Tree.

A correspondent writes from Antigua to say that he has observed a banana tree exhibiting unusual features of development. The tree to which reference is made, after it had borne a large bunch of bananas, was cut down, as usual, leaving about 12 to 14 inches of stump, around which were several suckers. Instead of the stump withering, as is usual, it commenced a fresh growth from the centre, as occurs in the case of young trees that have not borne. This shoot rapidly developed, sending out leaves, and finally grew to be a second tree, while the suckers all withered and died. The growth of the tree did not end there. After being manured, and the soil having been forked, the plant sent up two new suckers, and a second bunch of fruit has been put out, not coming up as usual out from the side, but it has shot up vigorously, as if from the heart of the tree, almost perpendicularly at first, though later its weight has inclined it so that it rests supported on the apparently abnormal growth of leaves. Our correspondent may be interested to know

that a similar case was recently noticed in a garden in Barbados. The growth described is of course abnormal, and it is difficult to assign any definite cause to the event.

The Green Lime Trade of Dominica.

One of the most remarkable West Indian trades that has grown up of recent years is the Dominica green lime trade, with New York. Almost every lime consumed in New York comes from Dominica. The demand arose, we believe, with the introduction of the drink known as the 'gin rickie' some fifteen years ago. For all other purposes for which sour citrus fruit are required, the lemon is almost entirely used. Thus the demand for Dominica limes depends upon an acquired taste of a somewhat special and restricted kind.

At present Dominica appears to be the only supply centre of green limes for New York, but it is hardly to be expected that the Americans will not make every effort to develop an industry of their own, in American tropical or sub-tropical territory, if they can. It is understood, indeed, that large areas are under limes in Porto Rico. Should a satisfactory export trade to New York become established from that island, it is possible that it might have injurious effects upon the Dominica trade. The demand will no doubt continue to expand, and there will be room for fruit from both islands; but it seems possible, in fact very probable, that limes from Porto Rico would be placed in the New York market in a better condition. The big American fruit companies would no doubt provide steamers with adequate cold storage accommodation. This would result in a very high percentage of the fruit reaching the consumer in a perfectly green condition, and not in a yellow and sometimes in a quite over-ripe state as occurs at present with the Dominica limes at certain periods of the year.

The American, like the West Indian, knows the difference between a green and a yellow lime in a beverage, and a green lime is preferred and wanted, and will be paid for. The flavour of the green rind is a very important factor in connexion with the value of the fruit in a beverage. It is not merely the lime juice itself.

It would be well if Dominica planters gave these facts their careful consideration. At the present time freight questions of any kind are problematical, but in the future it may happen that the progress of the green lime trade, and the development of other fruit trades will become more and more dependent upon adequate cold storage, or at least upon better storage than is available now. Meanwhile every care should be taken to ship only sound, well-graded and freshly picked green limes in order to maintain as high and uniform a standard as possible in the New York market.

Whatever other sources of supply may arise in the future, it is generally recognized from comparison with limes grown more or less experimentally in other places, that the Dominica fruit, owing to some factor of soil or climate or constitution, is superior to all others. The only problem is to market it in a satisfactory condition, and to avoid the waste which is reported to occur under existing conditions of shipment.

INSECT NOTES.

THE SCARABEE AND OTHER PESTS OF THE SWEET POTATO.

In view of the present food situation, special efforts are being made to plant various crops having a distinct food value. Among these will be the sweet potato, which is one of the commonest articles of food in these islands. It is advisable at the present time, therefore, to bring to the attention of planters and peasant proprietors some of the more important insects which are liable to attack this crop, and to suggest measures for their control.

Such insect pests as the scarabee or Jacobs, (*Euscepes* [Cryptorhynchus] *batatae*), the sweet potato moth (*Protoparce cingulata*, F.), red spider (*Tetranychus telarius*), etc., are well known to all growers of sweet potatoes and their importance is fully realized, often only after the damage has been done.

In these islands the sweet potato is attacked by various pests, most of which get their food from the leaves of this plant and can therefore be controlled by the use of stomach poisons or contact insecticides.

The scarabee, on the other hand, cannot be controlled in the ordinary way by poisons, since it spends most of its life underground, inside the potato tubers or in the plant stem. It must, therefore, be checked by some other means, and the most practical method known at present seems to be that of starving it out by systematically depriving it of its food-plant. It is known that the scarabee generally becomes a pest where sweet potatoes are grown for two years or more in the same fields, but that its ravages can be reduced by a judicious rotation of crops. Rotation of crops alone, however, is not stringent enough, and the food blockade to be effective, must be drawn still tighter. This can be done by planting potato slips known to be free from scarabee in land where no potatoes have grown for some time, and by keeping this up season after season accompanied at all times by clean cultivation.

In the first place, choose a plot of land where there have been no potatoes for several seasons, and plant it with 'pickings' or small pieces of roots taken from fields known to be free from the scarabee. These roots should first be carefully examined for any signs of the beetle, and all roots showing the slightest traces of infestation should be destroyed.

This land can be used as a nursery plot, and as soon as the plants are large enough, take cuttings and plant them in uninfested land. In those islands where the Experiment Station does not make a practice of growing and distributing sweet potato cuttings, the establishment of a nursery and the growing of plants for distribution are usually done by estate managers, who thus can insure the peasant proprietors getting a supply of clean plants. It then remains for the peasant growers themselves to see to it that these clean cuttings are set out in land where the scarabee has not been present for several years, and as far removed as possible from infestation by this insect.

The nursery plot referred to above should not be kept up for more than six to eight months, as after that time there is a possibility of the plants becoming infested with scarabee. At the end of this period the land used for the nursery can be forked over, and, if free from scarabee, can be used again for the same purpose. All land badly infested with scarabee can be planted in other crops, but care should be taken to clean the land as thoroughly as possible after gathering in the potato crop. All infested material, such as roots, vines, etc., should be buried with lime.

The following may be given as an example of the practical value of using clean plants in the control of the scarabee or Jacobs.

It has for some years been the practice at the Experiment Station in Antigua to grow different varieties of sweet potatoes. In this way the best varieties have been obtained, and these have been gradually distributed to growers throughout the island, who have extensively availed themselves of these opportunities of obtaining good cuttings. In the course of this work an area free from the scarabee has been effected, though perhaps this was not one of the gradually obtained, and the control of this pest at the Station original objects of the experiments. Within the last few years there has been a noticeable decrease of Jacobs in Antigua, and there is no doubt that the distribution of clean plants throughout the island, and the subsequent care in growing them have largely contributed to this decrease. This does not mean, however, that this pest is permanently controlled in Antigua, but that it has been reduced to the position where it can be kept in check in the future by a continuous employment of the same good methods. We have every reason to believe that these methods will be carried on with this further object in view, now that its importance has been realized.

The control of the scarabee or Jacobs has often been mentioned in the publications of the Imperial Department, but it has been given again at the same length in order to emphasize its importance at the present time and encourage growers to more persistent efforts to get rid of this pest.

While the scarabee is by far the most injurious pest of sweet potatoes, there are others which attack this crop from time to time, as is shown by the annual reports from the different islands.

Severe attacks of the caterpillar of the sweet potato moth (*Protoparce cingulata*, F.) sometimes result in the complete stripping of the vines over large areas; but fortunately, these attacks are comparatively rare, since this pest is usually controlled by its natural enemies, chiefly parasites. This and other caterpillars, such as those of *Sylepta helcitalis*, Wlk., attacking the leaves, can be killed by the use of arsenical poisons, such as Paris green, or arsenate of lead. The latter is preferable, as it is less likely to damage the leaves.

Several species of thrips sometimes occur on the underside of the leaves, perhaps the commonest being *Euthrips insularis*, Franklin. The red spider-mite (*Tetranychus telarius*) is also found on the underside of the leaves, and, as is also the case with thrips, is more abundant in dry weather, and especially in dry districts. Both thrips and 'red spider' can be controlled by dusting on a mixture of sulphur and lime, care being taken to reach these pests on the underside of the leaves.

Flea-beetles sometimes cause slight damage to the leaves of sweet potatoes, and grubs of the sugar-cane root borer and of the hard back occasionally attack the roots.

The sweet potato weevil (*Cylas formicarius*) is a pest in Jamaica, British Guiana, Cuba, the Bahamas, and the Southern United States, but so far is not known to occur in the Lesser Antilles. Its damage to the sweet potato is somewhat similar to that of the scarabee, and the remedies given for the scarabee can be applied to the weevil.

Mention may be made here of the slug (*Veronicella occidentalis*) which attacks many plants, including the sweet potato, when these are first set out, and sometimes does considerable damage. It is known in Dominica as the 'palute', and is called the 'leather jacket' in St. Lucia. At present the chief method of control seems to be collecting the slugs by skewering them on sharp-pointed stakes or iron rods. Some estates have tried the keeping of ducks to control this pest, with good results.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. The Agricultural Superintendent, Mr. W. N. Sands, reports that work in the Experiment Stations in January included picking cotton, and reaping arrowroot manurial plots and manufacturing starch from the roots. Several varieties of cowpeas were also sown. Plant distribution was carried on to a limited extent. In the Botanic Gardens the chief work performed during the month was the levelling and grading of the driving road through the Gardens. As regards staple crops, the manufacture of sugar and syrup was in progress, and cotton picking was practically finished. The Sea Island crop was estimated at 300 bales only, including stains, at a meeting of cotton growers held on the 31st. The first shipment of cotton was made during the month. Owing to a dry December the water-supplies of some estates were deficient and arrowroot reaping was retarded. Under the head of Pests, it is stated that cotton stainers were prevalent in the cotton fields generally, and a good deal of the cotton picked, was stained. Investigations of certain features connected with the life-history of the cotton stainer were continued, and with promising results. The work of eradicating the native food-plants of the pest was continued in the Leeward District.

The Superintendent paid a visit to the Carib Country to investigate a report that a new native food-plant of the cotton stainer had been found in the northern Windward District, which is called 'Dabarubois' by the Caribs. The tree was fairly common in the district, and its identity, from the fruits and leaves seen, has been established as *Sterculia caribaea*. The vernacular name would appear to be a corruption of Douve bois (Stave wood). In Dominica the tree is known as Mahoe-cochon. The identity of the species of stainer bug which is said to feed on the fruit has not yet been established.

The weather was seasonable; the rainfall evenly distributed—Botanic Station 7.46 inches, Experiment Station 7.57.

ST. LUCIA. According to Mr. A. J. Brooks the Agricultural Superintendent, work in the Experiment Stations and Botanic Gardens in January was of a routine nature. Plant distribution included the following: ornamental 12, economic 6, budded oranges 21, vegetable seeds 6 packets. The condition of the cacao crop is said to have slackened, while the lime crop was almost finished, and reaping operations in regard to sugar-cane were in full swing. Work in connexion with the extension of the Government Lime Juice Factory was continued. The boiler arrived from England and has been placed in position and fitted ready for working. Mr. Buckmire arrived in the colony and took up the duties of Agricultural Assistant.

Considerable attention has been paid to the question of manufacturing potato flour on a large scale. Practical results have been obtained, and palatable bread containing 25 per cent. of potato flour has been made. A scheme has been drawn up, and since approved by the Governor-in-Council, to extend this work on a commercial scale.

The Agricultural Superintendent attended a meeting of the Agricultural and Commercial Society on January 9, when the Society approved the Prize Holdings Scheme for cacao and limes, drawn up by that officer. A coming event of interest is the proposed erection of suitable building and machinery at Réunion for the manufacture of farine and potato flour.

NEVIS. Mr. W. I. Howell, Agricultural Instructor, in his report for the month of January, says in reference to the Experiment Stations, that the crops all continue to do well, good returns being obtained from those reaped during the month. Second picking had commenced in the cotton demonstration plot, but the crop will not be a large one, and there is a fairly high percentage of stained cotton. The onion crop is ripening and reaping has begun; the curing house is ready, and onions can now be received for curing. Plant distribution included 9,850 sweet potato cuttings, 188 lb. Guinea corn, 29 lb. Indian corn, 2 lb. black-eye peas, and 2 lb. Lima beans. Regarding staple crops, the reaping of the cane crop is in progress throughout the island, but poor yields are being obtained. Planting for next season's crop is still in progress and germination is fairly good; in some places however, the crop is suffering from the dry weather. The cotton crop has nearly all been reaped, and some of the old fields are being cut down and preparation made for the new crop. The provision crops are being reaped, but the weather is too dry just now for planting. Cotton stainers and leaf-blister mite are very prevalent. The rainfall recorded for the month was only 1.39 inches.

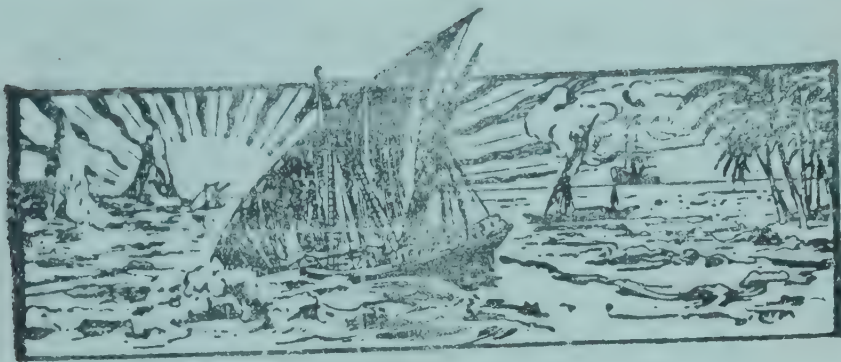
VIRGIN ISLANDS. Mr. W. C. Fishlock writes to say that during the month of January, in the Experiment Stations, the work of clearing up wreckage left by the storm was continued. Considerable work was done in connexion with weeding, planting out and distribution of onion seedlings, the area under cultivation being about $\frac{1}{2}$ acre. Plant distribution included 73,100 onion seedlings, 30 lb. Irish potatoes, and 14 tomato slips. There is little to report, adds the Curator, as regards staple crops. Rainfall for the month was 1.87 inches, as compared with 3.00 inches, the average for the last sixteen years.

TEPHROSIA PURPUREA AS A DYE PLANT.

An interesting account of indigenous dye-producing plants of India appears in the *Tropical Agriculturist* for November 1916, from which the following note on *Tephrosia purpurea*, well known as a green dressing plant in the West Indies, is reproduced:—

This is a small woody annual occurring in abundance in the United Provinces. It does not contain any substance yielding indigo, and its name 'Jangli Nil' is probably due to its similarity to the indigo plant.

Clarke and Banerjee have examined the constituents of the leaves of this plant. They found in it a colouring principle allied to quercetin or quercitrin (vide *Transactions Chemical Society*, 1910, Vol. 97). Owing to the difficulty of separating the yellow principle from the chlorophyll, efforts to obtain a pure yellow from *Tephrosia* have only been partly successful. The colouring matter is however of great value, as it yields dyeings which are comparatively fast to light washing and milling. The yellow principle was separated by extracting the dry leaves with alcohol, diluting the extract with water, and washing away the chlorophyll with petrol. The purified colouring matter gave excellent shades of yellow in conjunction with various mordants. On account of the abundance of the plant it may be worth while devising a suitable process for extracting the yellow colouring principle. It would, no doubt, be very welcome wherever Fustic and quercitron bark are still in use. A decoction of the leaves of *Tephrosia* dyes wool mostly dull brown shades in conjunction with the various mordants, the most brilliant shade being that on Tin Mordant. The dyeings, however, possess very good fastness to milling.



GLEANINGS.

It appears from the *London Chamber of Commerce Journal* that there are great possibilities for the cultivation of sisal in Egypt. Those interested in this question, and in the development of sisal plantations, should communicate with the Ministry of Finance, Cairo.

It is somewhat surprising to learn that in Porto Rico there is an actual decrease in the acreage of cane now under production. The *Louisiana Planter* for December 30, 1916, states that grinding began very early for the present crop. It is added that excessive rainfall injured seed cane.

What is believed to be the largest Hevea rubber tree is described in the *India Rubber World* for January 1. The tree, which is situated near the river Acre, in Brazil, is 127 feet in circumference at the base, and has a record of yielding for 120 days an average of 22 lb. of rubber a day.

Many lines of research, says *Science* for October 6, 1916, are in daily progress in our laboratories, whose object is the discovery of 'accelerants' for certain chemical reactions. It is asked whether it should not be found possible to discover specific 'accelerants' which would increase the rate at which potash could be rendered available for the use of the plant in the soil.

According to a special article in *Science* for October 6, 1916, experiments with discs of *Opuntia* have shown that both young and old plant tissues take up more water when neutral or alkaline. Acidity, therefore, in addition to retarding enzymatic action, presumably including respiration, would operate to lessen growth by its effects in decreasing imbibition by plant tissues.

It is stated in the *Louisiana Planter* for January 20, 1917, that the outlook for the sugar crop in Panay and Negros, of the Philippines, is not good. Since planting time of last year up to December there had been only about twenty consecutive days of sunshine. It rained almost continuously, and many planters were obliged to replant their fields several times.

According to the *Wealth of India* for November 1916, a French journal claims that in the French Army exhausted orange peel is employed as an aperient. The peel is boiled for an hour. The liquid is used for preparing flavouring mixtures, and the refuse is dried and given freely. It not only seems to stimulate the action of the intestinal canal, but stimulates as well the flow of bile.

Reference is made in the *International Sugar Journal* to the severe drought that has been experienced during the past year in the Argentine. This has not only reduced the sugar output but has made the grain crop almost a total failure. The Argentine Government has just issued a decree, which permits of the importation of 75,000 tons of sugar, 55,000 tons of which will be refined. Usually the Argentine can manage to export considerable quantities of sugar.

Spirochaetes—elongated, spiral micro-organisms—occur very commonly in the intestinal canal of man and animals, supposedly as harmless saprophytes. In a paper in the *Annals of Tropical Medicine and Parasitology*, however, it is suggested that they may be capable of pathological activity, either by preading into the blood vessels and producing a generalized infection, or by invading the cells of the intestinal walls, or even by mechanical irritation.

A suggestive address is published in *Science* for October 6, 1916, on the analysis of living matter through its reactions to poisons. It is claimed that we must attempt to classify living tissues in groups not determined by their morphological or even functional characters, but by their ability to react to chemical agents. The reaction of tissue to alkaloids is especially interesting, and the correlations should enable one to detect the presence of certain poisons by the reactions of the tissues, as well as the tissues by their reactions to poisons.

The death is announced, in *Nature* for January 25, of Dr. Henri Emile Sauvage, founder, and until recently, director, of the Station Aquicole, Boulogne-sur-Mer. Dr. Sauvage studied fishes, both recent and fossil, from every point of view, and published a long series of memoirs and papers bearing both on zoology and geology, and on several economic questions connected with these sciences. He made many contributions to knowledge of the fishes of West Africa, Indo-China, and Madagascar.

Mr. A. O. Thurston of St. Kitts has done much to remove once and for all the impression that has prevailed in certain official quarters of the United States, that the West Indies are not provided with efficient milling plants for grinding sugar cane. In the *Louisiana Planter* for January 6, two photographs of the St. Kitts Central and its shipping wharves are published, together with a letter and other information sent by Mr. Thurston to show that even a small island like St. Kitts can easily stand comparison in regard to equipment with anything on the same scale in Cuba or America.

Reference is made in the *London Chamber of Commerce Journal* for January 1917 to Brazilian Piteira fibre. Commenting on this commodity, Mr. Lyster H. Dewey, Botanist in charge of fibre investigations, United States Department of Agriculture, says: 'There would probably be little difficulty in finding a market for piteira fibre in the United States at the present time if it can be produced in commercial quantities, and of a uniform quality equal to the sample submitted. In order to obtain the best market value, the fibre should be cleaned directly from the freshly cut green leaves and not from water-soaked leaves. It is very doubtful, however, whether this fibre, which is finer and softer than henequen from Yucatan, would command a price equal to henequen fibre, especially for the first shipments. Manufacturers could not afford to pay more for this fibre than for henequen until they had learned by actual experience how it could be worked up to best advantage.'

WORK OF THE AGRICULTURAL DEPARTMENT IN GRENADA.

The periodical progress report on the work of the Agricultural Department, Grenada, for the quarter ended December 31, 1916, has been received, and the chief points of interest are summarized in the following notes.

Agricultural inspection and instruction in the country districts included visits to estates in St. John's and St. Mark's in connexion with cacao thrips investigation; and in St. George's, St. David's and St. Andrew's on froghopper investigation and control work. A demonstration in concentrating lime juice was also given in St. Andrew's.

The Agricultural Instructors brought the work in connexion with the Prize Holdings Competition to a close, with the judging of the holdings, and taking part in the meetings held for the distribution of the prizes. Besides their general instruction work, they were engaged, amongst other matters, on corn selection for seed storage purposes and investigation in connexion with the shortage of cattle for food.

Work in the Botanic Gardens has included, in addition to the routine matters, operations of economic value such as the sowing and resowing of lime seeds to provide 30,000 plants potting and grafting mango plants, budding orange plants, and transplanting orange stocks, constructing temporary corn-drying racks, and fumigating corn on the cob.

In regard to the experiment stations, it is stated that at the lime stations in the various parishes, the progress of the lime trees is on the whole, satisfactory. Routine work has been maintained, and crops of yams, horse beans, tannias, Lima beans, cowpeas, etc., are being harvested.

Concerning industrial progress, it is mentioned that the total picking of cacao to the end of December, though not up to the level of last year, which was unusually high, is equal to a good average crop. The nutmeg crop is reported to be showing very satisfactory progress. Good progress has been made in lime planting during the quarter; this work has now closed down, awaiting the next planting season.

During 1915 and 1916 the number of lime plants distributed by the Agricultural Department totalled 54,451, which, allowing for losses and variation in planting distances, are sufficient to establish about 365 acres. The acreage under limes at the end of 1916, is estimated as follows: Grenada, 533 acres; Carriacou, 591; or a total of 1,124 acres. In view of the increasing extension in lime cultivation, it is suggested that the time is approaching when the question of establishing a Government lime juice factory on the lines of that in St. Lucia, may usefully be considered.

The pests observed during the quarter were the sugarcane froghopper, said to be closely allied to or identical with *Tomaspis varia*—the species which for some years has been a destructive pest on canes in Trinidad;—and cacao thrips. Remedies for combating these were advised and applied.

In regard to Land Settlements, normal progress appears to have been maintained in this section of the Department's work. As a measure of precaution against possible shortage of seed corn among peasants for spring sowing, 60 barrels of corn on the cob, selected from peasants' crops in November were purchased, and stored at the Botanic Gardens. The corn was hung on specially constructed drying racks, to be subsequently shelled and stored in a bin.

Details are given in the report under review in regard to plant distribution, which show a total of 8,528 for the quarter, and 30,332 for the period April-December; exclusive of a large number of seeds and cuttings. This reflects the importance of the nursery work at the Botanic Gardens in developing the local agricultural industries.

Agricultural Instruction Work in Grenada.

—His Excellency the Governor of the Windward Islands has furnished this Office with copies of the monthly reports of the Agricultural Instructors of the Department of Agriculture, Grenada, for January 1917. Both reports show evidence of very considerable activity. It is stated in the first that the peasant proprietors' holdings were visited in the Parishes of St. David and St. Andrew. The land settlement and experiment plots at Morne Rouge, Westerhall, and St. Cyr Mountain were also visited. Attention was given to the problem of thrips control, and estates were visited in connexion with this and other pests. Progress of work on the experiment plots appears to have been satisfactory. Good crops of beans and peas were obtained and cotton was found to be satisfactory in Carriacou. As regards the condition of crops on the estates, cacao was coming in satisfactorily, and although it is unlikely that this crop will reach as high a figure as the last, yet the prospects are good for an average crop. The prospects of the nutmeg crop are recorded as being satisfactory. Oranges have yielded an abundant crop and are still plentiful. There has been a considerable waste in this crop during the season. The suggestion might be made in connexion with this that it might prove practicable to manufacture orange oil from the surplus fruit.

The report of the second Agricultural Instructor refers to visits paid to St. John's Parish, St. Mark's and St. George's. Instruction work was of the same character as formerly, stress being laid upon the need for deeper and more properly placed drains. Good methods of culture were recommended. Many peasants were encouraged, and many have promised to enter and compete under the next prize-holdings scheme to be held this year. It is satisfactory to learn that the mountain lands are being cleared by the peasantry for the purpose of cultivating ground provisions. Despite the severity of thrips attacks, the cacao crop was considered likely to be a normal one. The report concludes with a few remarks on live stock. The number of animals in the island appears to be below the requirements. It is suggested that efforts to encourage the rearing of more animals might be stimulated by the formation of a breeders' association, either under the auspices of or through the Agricultural Society.

Board of Agriculture, British Guiana.—The Secretary of the Board of Agriculture, British Guiana, has furnished this Office with a copy of the agenda of a meeting of the Board held on February 1, together with an extract giving an account of the meeting. Amongst the various matters referred to by Professor J. B. Harrison, C.M.G., was the action taken by the Board to issue special posters giving directions for rice planting. A scheme adopted by the Combined Court, for the training of student assistants at the Department of Science and Agriculture, was then laid on the table. After referring to the desirability of adopting in British Guiana, the Jamaica scheme of subsidized men as Agricultural Instructors, the Director proceeded to refer to the demonstration plots in Berbice and the Victoria Belfield Agricultural Show, which does not appear to have been as successful as might be desired. Professor Harrison then said that at the last meeting it was decided to place at the disposal of the Agricultural Association a few boars of good breed for the rearing of pigs in important centres. Two boars had been purchased for the purpose, but the difficulty arose as to the cost of housing the animals. Amongst the final matters referred to was the satisfactory sale of the rubber grown by the Department in 1916. One quantity of this rubber, about 1,000 lb., fetched 3s. 4½d. per lb., and another lot, a little over 500 lb., realized 2s. 6½d. per lb., while a third lot, 1,000 lb., was now awaiting sale.

PLANT DISEASES.

CITRUS CANKER IN SOUTH AFRICA.

Miss Ethel M. Doidge, Mycologist to the Union Department of Agriculture, South Africa, gives an account, in *Science Bulletin* No. 18 of the Department, of the origin and history of citrus canker in that country. In 1905-6 a number of grape-fruit trees were imported from Florida and planted in the Government Experimental Orchard at Warmbaths, in the Transvaal. When the trees began to bear in 1908, a few spots were noticed on the fruit, and in the wet summer of 1908-9, the disease began to spread with incredible rapidity and went right through the orchard. Vigorous remedial measures were applied, and the trees were repeatedly sprayed with ammoniacal copper carbonate. In spite of this, the whole lemon and orange crop of 1909 was too unsightly to sell. In 1910 the trees were pruned and sprayed with Bordeaux mixture, which checked the disease at once. The new growth was healthy, and the 1911 fruit crop free from disease. Spraying was repeated in 1911 and 1912, and nothing more was seen of the disease until 1916, when slight infections were noticed on a few grape-fruit trees.

This success of Bordeaux spraying is in direct contrast to the recorded Florida experience, but agrees with the Texas experience described by Grossenbacher (*Phytopathology*, VI, p. 29).

A few other Transvaal orchards have been found to be affected, and in each case the disease can be traced to the importation already referred to.

Miss Doidge has established, by cultural methods, the identity of this causative bacterium with *Pseudomonas citri*, Hasse, now accepted as the cause of the Florida outbreak.

The story is not without its moral for West Indian planters in general. So far as this particular disease is concerned, the legislative action taken should be sufficient, provided that the regulations made are carefully enforced. A number of citrus plants imported from Florida before the existence of this disease was known have been examined at the Dominica Gardens by the writer, and have shown no sign of infection.

A COLLAR DISEASE OF PIGEON PEAS.

Mr. J. C. Moore, Superintendent of Agriculture, Grenada, has forwarded a report by Mr. Malins-Smith on a disease of the pigeon pea bush, *Cajanus indicus*, which has caused somewhat serious losses in the island of Carriacou. The disease has a scattered distribution but is held to be responsible in some areas for the death of as many as fifty trees to the acre.

A number of specimens have been forwarded for examination, and from these it would appear that the seat of the affection is in the stem and roots in the neighbourhood of the collar. Several fungi were present on the specimens, but of these the only one which appeared to be quite general, and to be most closely associated with the lesions found, is an Ascomycete which forms a black stroma throughout the bark of the affected regions, and produces very numerous perithecia and pycnidia in the outer bark. The perithecia occur in dense clusters, more or less united towards the base, and have rather long necks which project through cracks in the outer bark. As the latter weathers

away the perithecia themselves become exposed. Both pycnosporos and ascospores are ejected in white tendrils. The former are oval or oblong, the latter are somewhat irregular in outline but tending to be coffin-shaped. Both are unicellular and hyaline. The wood becomes filled with dark-coloured hyphae which give to it a slaty grey appearance. Some of the thicker stems were split radially and fluted, owing to the development of longitudinal ribs of new wood on the surviving sectors of previously diseased stems. It would seem that the disease is one that only makes headway at certain seasons. Inoculation experiments will be made with the fungus when the conditions appear more suitable than they are in the present dry weather.

As the disease is present mainly or entirely in peasant holdings, an attempt is being made with the aid of a grant of £10 from the Grenada Government to reduce the prevalence of the disease by digging up and burning the affected plants under official supervision.

Stem or root diseases of pigeon pea are rather frequent in these islands, but so far as is known to the present writer they have been sporadic in their occurrence and have received little attention. It is desirable, now that the subject has been brought to notice, that the occurrence of any cases should be reported to this Office for investigation.

POISONING A COCO-NUT PALM.

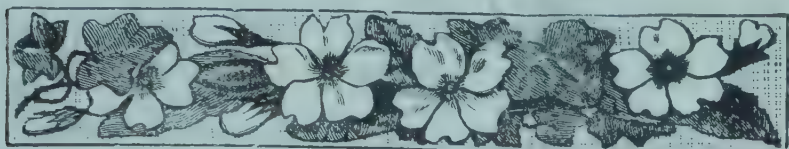
Reference has been made in this Journal (Vol. XV, p. 254) to the poisoning of trees with sodium arsenite, and particulars given of a method of application which has been adopted with success in the case of the ordinary (dicotyledonous) type of tree.

The writer recently had occasion to test the effect of the poison on a well-grown but almost barren coco-nut palm some twenty years old. With a 1-inch auger a hole was bored slanting downwards into the base of the stem, penetrating about two-thirds of the diameter. About 1½ oz. of sodium arsenite was introduced, the hole filled with water, and plugged. The water was renewed two or three times in the next few days. At the end of one week the expanded leaves had assumed a reddish colour; in two weeks all the leaves were obviously dead, and towards the end of the third week the central column, including the bud, came to the ground.

There has been some dispute, in discussions, of the effects of coco-nut root diseases, as to whether the rotting of the bud observed in many cases was to be considered as a consequence of the root trouble, or of an infection with the bud-rot disease.

It is noteworthy that in this poisoned tree the soft tissues about the base of the central column became involved in a putrid soft rot, and this so quickly, that in less than three weeks the whole heart came away. The weather during the period was very dry and windy, and the tree was in an exposed position. There can hardly in this case be any question of infection with a special bud-rot organism, since the disease is quite unknown in Barbados.

Excepting the reddening of the outer leaves, the general appearance of the tree was exactly that described as typical for the form of bud-rot disease which first affects the heart. The experience emphasizes the need for caution in attributing this type of failure to the presence of the specific bud-rot disease. Apparently the infectious nature of that affection is, in the present state of our knowledge, the only distinguishing feature on which reliance can be placed.



NOTES ON PLANTS IN THE ST. VINCENT BOTANIC GARDENS.

Each year the Report on the Agricultural Department of St. Vincent contains interesting observations on plants established, or newly introduced into this Garden. During 1915-16, a new rose garden was formed in a portion of the nutmeg grove, which was cleared for the purpose. The roses planted consisted of those which had been found to thrive fairly well under local conditions. There were several good roses whose names were not known, but among the named varieties were the following:—

Mamam Cochet	Waban
Souvenir de la Malmaison	York and Lancaster
Snow Flake	Dexiensiensis
Champion of the World	Prince Rupert
Bertha Clavel	La Martinique
Souvenir d'un Ami	Madame Cammille
Catherine Mermet	Marie Guillot.
The Bride	Niphetos.
Monthly	Marie van Houte
Ruben	Etoile de Lyons
La France	Paul Neyron

A few years ago there was introduced from Trinidad the Nicaragua cacao shade tree or 'Madura' (*Gliricidia maculata*). This proved to be a most useful introduction. It is now distributed throughout the Colony, and besides its use as a shade tree for cacao, it is extensively employed for wind-breaks, hedges, fence and pen posts. The tree grows readily from cuttings of all sizes, and is rapidly supplanting other native trees used for similar purposes. Being a leguminous tree, it enriches in nitrogen the soil in which it grows so that plants in adjoining lands do not suffer. The prunings also make an excellent mulch for arrowroot and other crops.

The result of grafting the terra-cotta Bougainvillaea (*Bougainvillaea spectabilis*, var. *laterita*) on the common *Bougainvillaea glabra*, var. *Sanderiana*, has proved a success in that the species grew and flowered much better and was far less affected by wet weather than when grown on its own roots.

The silvery-leaved juniper (*Juniperus pachyphloea*) continued to thrive; one of the plants is already 4 feet in height.

During investigations connected with the local flora, the Agricultural Superintendent discovered a white-flowered variety of the 'Easter Blossom' (*Securidaca Lamarchii*). Enquires were made of different botanical authorities, but this form does not appear to have been previously noted. The plant is likely to be an interesting and useful acquisition to the Gardens. It was propagated by means of cuttings.

In a recent issue of this Journal, the interesting old tree, the only specimen known,—*Spachea perforata*,—showed signs of decay, and it is unlikely that it will survive many years; fortunately a limited number of young plants have been raised, one of which was planted out in the Gardens.

The flowering and fruiting of the Cow tree (*Brosimum galactodendron*) has to be recorded. This tree yields a milk which is commonly used as an article of food in South America. The milk is obtained by making incisions in the trunk. It is stated in the *Treasury of Botany* that, unlike many other vegetable milks, it is perfectly wholesome and very nourishing, possessing an agreeable taste, like that of sweet cream, and a pleasant balsamic odour; its only unpleasant quality being a slight amount of stickiness.

Abnormal Rainfall in St. Vincent.—His Honour the Administrator of St. Vincent has furnished this Office with an interesting chart, prepared by Mr. W. N. Sands, Agricultural Superintendent, showing the annual rainfall at the Botanic Gardens in St. Vincent for the last twenty-three years. His Honour points out that the total rainfall in 1916, namely 137.63 inches, was by far the highest recorded during that period, being 31.25 inches, or 29.3 per cent. in excess of the annual average of 106.38 inches for the preceding twenty-two years. It is expected that this chart will be published in the next annual report on the St. Vincent Department of Agriculture.

Further Work against the Cotton Stainer in St. Vincent.—Mr. W. N. Sands's campaign against the cotton stainer in St. Vincent by means of the eradication of the food-plants of this pest, chiefly John Bull and silk-cotton trees, continues with unabated vigour. Up to January 31 a total of 11,566 John Bull trees, and 1,148 silk-cotton trees, in addition to thousands of seedlings had been destroyed. As previously pointed out in other references to this work, gangs of men under special inspectors have been enrolled, and the discovery and felling of these large trees call for much energy and perseverance. Up to January 31, the expenditure was £232 16s., which total includes claims for damage to property amounting to £40 5s. 6d.

The effect of the above work, which appears to be making good progress and, we hope, nearing completion, will no doubt be seen in the improved condition and more satisfactory yields from the cotton crop next to be planted.

Poisonous Lobsters.—The book dealing with the history of Nevis, referred to in a note in our last issue, contains an interesting reference to the poisonous character of certain lobsters. According to the writer, the Rev. Smith, the lobsters that are found on the western or leeward side of the island were in his day regarded as very fine eating, whereas those taken on the eastern or windward side were found to be poisonous. This was attributed to some unwholesome kind of food on the windward side, and was imagined to be something containing a virus. The poison is stated to have worked strongly, producing violent vomiting and other painful and dangerous effects.

DEPARTMENT NEWS.

Information has been received by cable to the effect that the Imperial Commissioner of Agriculture arrived in Jamaica on February 24. As stated in the previous issue of this Journal, Sir Francis Watts left for Jamaica on February 19; he is expected to return to Barbados some time in April.

The scaracity of potash has stimulated enquiries in Queensland concerning the potash content of certain trees, small plants and shrubs. According to the *Queensland Agricultural Journal*, the ash of 'Blood-wood' contains 5.52 per cent. of potash, while that of 'Red gum' contains 4.17. The ash of pine-apple plants contains 15.02; banana plants 38.84; sisal hemp 8.00; cane tops 6.49; and cane trash 4.90 per cent.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
January 25, 1917.

ARROWROOT—2 $\frac{1}{10}$ d. to 3 $\frac{1}{2}$ d.
BALATA—Block, 2/5 $\frac{1}{2}$ to 2/10 $\frac{1}{2}$; Sheet, 3/8 to 3/9.
BEESWAX—No quotations.
CACAO—Trinidad, 78/-; Grenada, 60/- to 71/6; Jamaica, 62/-.
COFFEE—Jamaica, no quotations.
COPRA—£43 10s to £44.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 34d. to 36d.
FRUIT—Bananas, £17 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, 49/- to 63/-.
LIME JUICE—Raw, 2/9; concentrated, £22; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—1d. to 2d.
NUTMEGS—10d. to 2/-.
PIMENTO—3 $\frac{3}{4}$ d.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, 4/6 to 4/7.

New York.—Messrs. GILLESPIE BROS. & Co., February 9, 1917.

CACAO—Caracas, 15c. to 15 $\frac{1}{2}$ c.; Grenada, 14 $\frac{1}{2}$ c. to 14 $\frac{3}{4}$ c.; Trinidad, 14 $\frac{1}{2}$ c. to 14 $\frac{3}{4}$ c.; Jamaica, 12 $\frac{1}{2}$ c. to 13c.;
COCO-NUTS—Jamaica and Trinidad selects, \$21.00 to \$22.00; culls, \$12.00 to \$13.00.
COFFEE—Jamaica, 10c. to 12c. per lb.
GINGER—15 $\frac{1}{2}$ c. to 18c. per lb.
GOAT SKINS—Jamaica, \$1.25; Antigua and Barbados, \$1.15 to \$1.25; St. Thomas and St. Kitts, \$1.00 to \$1.15 per lb.
GRAPE FRUIT—Jamaica, \$1.50 to \$1.75.
LIMES—\$5.00 to \$6.00.
MACE—41c. to 48c. per lb.
NUTMEGS—22c. to 24c.
ORANGES—\$1.50 to \$2.00.
PIMENTO—5 $\frac{3}{4}$ c. per lb.
SUGAR—Centrifugals, 96°, 4.89c; Muscovados, 89°, 4.28c.; Molasses, 89°, 3.89c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., February 23, 1917.

CACAO—Venezuelan, \$14.00 to \$14.25; Trinidad, \$17.28 to \$17.76.
COCO-NUT OIL—\$1.45 per Imperial gallon.
COFFEE—Venezuelan, 12 $\frac{1}{2}$ c. to 14 $\frac{1}{2}$ c.
COPRA—\$7.25 per 100 lb.
DHAI—No quotations.
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$8.40 to \$8.75; White, \$9.25 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., February 20, 1917; Jas. A. Lynch & Co., Ltd., February 21, 1917.

ARROWROOT—\$5.00 per 100 lb.
CACAO—\$11.00 to \$12.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—\$1.80 per 100 lb.
MANURES—Nitrate of soda, \$90.00; Cacao manure, no quotations; Sulphate of ammonia, \$110.00 to \$112.00 per ton.
MOLASSES—No quotations.
ONIONS—\$6.03 to \$7.00.
PEAS, SPLIT—\$9.75 to \$10.00; Canada, no quotations.
POTATOES—Nova Scotia, \$6.00.
RICE—Ballam, \$8.55; Patna, no quotations; Rangoon no quotations.
SUGAR—Muscovado centrifugals, \$4.50.

British Guiana.—Messrs. WIETING & RICHTER, December 30, 1916; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	\$11.00	
BALATA—Venezuela block		
Demerara sheet	\$65.00	
CACAO—Native	16c. per lb.	
CASSAVA—	84c.	
CASSAVA STARCH—	\$9.00	
COCO-NUTS—	\$20 to \$24 per M.	
COFFEE—Creole	12c. to 13c.	
Jamaica and Rio	15c. per lb.	
Liberian	11c.	
DHAL—	\$6.50 to \$8.00	
Green Dhal		
EDDOES—	96c.	
MOLASSES—Yellow	None	
ONIONS—Teneriffe		
Madeira	7c. to 8c.	
PEAS—Split	\$12.00 to \$12.50	
Marseilles		
PLANTAINS—	32c. to 60c.	
POTATOES—Nova Scotia	\$5.25 to \$5.50	
Lisbon		
POTATOES—Sweet, B'bados	\$1.92	
RICE—Ballam	\$7.00	
Creole		
TANNIAS—	\$2.88	
YAMS—White	\$2.40	
Buck		
SUGAR—Dark crystals	\$3.40 to \$4.50	
Yellow	\$5.00 to \$5.10	
White	\$7.00	
Molasses		
TIMBER—GREENHEART	48c. to 72c. per cub. foot	
Wallaba shingles	\$5.50 to \$7.50 per M.	
„ Cordwood	\$3.00 to \$4.00 per ton	

NO QUOTATIONS.



A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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New Food Plants for the West Indies.

At the present time attention is being given in most of the West Indian islands to the question of increased food production. The extension of the area under provision crops is being advocated, and interesting results have already been obtained in regard to the use of substitutes for imported wheat flour.

Speaking generally the production of provision crops like sweet potatoes and yams offers no special difficulties from an agricultural stand-point: the only

trouble is to persuade cultivators to plant these crops rather than the seemingly more profitable crops for export like sugar or cotton. But when we come to food-crops characterized by their high nitrogen content, or by other special characters of dietetic importance, there appear to be certain difficulties in regard to actual production. Thus, in a general way, the cultivation of peas and beans is attended with insect troubles; while wheat will not grow at all in the tropics at ordinary elevations. Neither are the conditions in the smaller islands suited to rice; and even Indian corn, though it can be readily grown, cannot be stored without special treatment.

As regards beans and peas, the above remark concerning insect pests refers more particularly to those species specially favoured as vegetables.

There are other species, however, which though grown principally as green dressings could also be made to yield food for consumption without the attending difficulties of susceptibility to the attack of insects. The Canavalias—the Sword bean and the Horse bean—deserve special consideration in this regard, and the attention of the reader is directed to a note on these beans as food-crops on another page of this issue. It is commonly supposed that the Canavalias are poisonous or unwholesome, or at least unpalatable. The more the matter is enquired into the more the evidence found to dispel such a notion. Actual trial has shown the Sword bean (*C. gladiata*) to be entirely wholesome and palatable. In regard to the Horse bean (*C. ensiformis*), a recently issued Philippine publication* says the beans 'in a tender, immature state, may be eaten like string beans. Used dry like beans, the beans should

*The *Philippine Agricultural Review* (Vol. IX, No. 3)—
 'The Food Plants of the Philippines', by P. I. Wester.

be soaked in cold water and be given an extra boiling in changed water in order to be palatable.

Since there is no difficulty attached to growing these species on a field scale in the West Indian islands, it seems a pity to neglect such a useful and prolific source of rich vegetable food.

Turning now to a consideration of the local production of cereals, it would obviously be a very useful thing if a really good tropical substitute for wheat could be found. Wheat, as is well known, possesses certain characteristics which make it the only suitable cereal for the making of good bread. Corn meal, bean meal, or sweet potato meal may be used to dilute wheat flour, but they can only be used in very limited quantities.

For many months, since the flour question has been a topic of interest and some concern, we have endeavoured to find references to cereals other than wheat used for bread making in other parts of the world. It is of considerable interest to record the fact, which may not generally be known, that a cultivated form of the grass known as Job's Tears (*Coix Lacryma-Jobi*)—a fairly common grass in the West Indies—is extensively grown as a cereal in parts of India.

According to Watt*, 'From Darjeeling and through Blatan to the mountains of Upper and Eastern Assam, the Khasia Garo and Naga Hills, etc., to Burma and the Shan States, Coix might be described as not only a fairly plentiful crop but an exceedingly important article of diet. Certain forms of the grain are roasted, then husked and eaten whole, being either parched (as with Indian corn), or boiled as with rice. Other forms are so very different that the grain may be milled and ground to flour (átá) and thereafter baked into bread. It seems probable that the properties that necessitate so very different methods of treatment and preparation involve a diversity chemically and structurally quite as great as that which exists between the hard and the soft wheats or the glutinous and the starchy rices.' Again, in another place it is stated, the plant is of a 'very hardy nature, and thrives upon almost any kind of soil, yielding a good amount of produce, and in taste resembling wheat.'

Job's Tears is known best in the West Indies as the source of vegetable beads which are used for making into curtains. These beads consist of the hardened pear-shaped body at the base of each inverted

inflorescence, which is the sheath of the bract of the inflorescence. But in the case of the cultivated varieties in India and China, the curious structure referred to remains soft and edible. Thus we read that 'Coix forms a good example of the results of cultivation of a wild plant the seed of which is of a stony hardness, but which is soft in the cultivated form, and the kernel sweet'.

As to the nutritive value of Coix grain, figures given by Church† may be of interest; he found that cultivated Coix, Khasia Hills, had a nutrient ratio of 1: 4.4, and a nutrient value of 90. The husked grain contained about 19 per cent. of protein, which is very high for a cereal. Commenting on his final results, Church says that the quantity of albuminoids (protein) approaches to that of some kinds of pulse, and that the proportion of oil or fat is larger than that present in the great majority of cereals.

These facts have led us to suggest that the cultivated forms of this plant might be grown in the West Indies; at any rate a few plots under this crop at the Experiment Stations would be interesting. They would furnish some idea of the yields of grain to be expected, the value of the flour produced from it for bread making, and the yield of fodder that can be obtained. It might be mentioned that attention is being given to this crop in the Philippines, where it is rather regarded as likely to prove a valuable subsidiary food-crop.

Porto Rican Sugar-cane Crop.—Writing from San Juan on February, 14, 1917, the correspondent of the *Louisiana Planter* says:—

'The present cane-grinding season here has now reached its height, with every cane mill grinding at full capacity and the cane being harvested rapidly. The weather has been wonderfully good ever since the commencement of the grinding season and not a day's work has been lost in the fields. Sugar men generally are extremely satisfied with the progress made so far, and with the labourers still working contentedly the fears which recently have been felt that a general strike was imminent are fast disappearing, as no further move has been made by Santiago Iglesias, who threatened to bring the members of the Federation of Labour out at the commencement of February if his demands for a dollar minimum and an eight-hour day were not met.

'As predicted early in the season, the effects of the continued rains for months prior to the commencement of the harvest are now being felt in the decreased tonnage of sugar per acre as compared with last year. There has however been a decided recovery recently, and sugar men are expecting that the total production will fully come up to the original estimates of over 500,000 short tons for the season.'

* 'The Commercial Products of India' by Sir George Watt.

† 'Food Grains of India', *Supplement*, 1901.

NOTES ON THE ANTIGUA AND ST. KITTS CENTRAL FACTORIES.

On the basis of the 1916 crop, the total capital cost of the Company's property in St. Kitts works out at £15 8s. 10d. per ton of sugar, a moderate figure for a factory fitted out with such excellent plant, and with its own railway, pier and sugar store.

The following figures give the results for the year 1916:—

	1916.
Canes	101,248 tons
Sugar	11,591
Sucrose in cane	12.84
„ „ megass	2.99
Purity of juice	84.70
Recovery of sucrose	8.557
Yield of sugar 96 degrees	11.44
Price of sugar per ton	£17 18s. 10d.

After charging Revenue with £18,000 for debenture interest and sinking fund, additions, sinking fund and railway extension loan, there remains a surplus of £66,641 7s. to be allocated as follows:—

The Original Contractors £33,320 13s. 6d., giving a supplementary payment of 7s. 3¼d. per ton of canes, making a total of 24s. 3¼d. per ton.

To 'A' Shareholders £33,320 13s. 6d., bringing the total at their credit to £39,352 10s. 9d., subject to liability for Excess Profit Duty.

The Directors recommend the payment of a dividend of 2s. per share, which will absorb £6,500, leaving £32,852 10s. 9d. to be carried forward subject to Excess Profit Tax, as above stated, and Income Tax. After deduction of these charges, the balance, which is left meantime with the Company for the purpose of finance, will be credited with interest at 5 per cent. per annum.

To Factory charges	£2 4s. 1¾d. per ton sugar
To Railway transport	8 7¼
To Admission charges	3 0 3¼

The Imperial Commissioner of Agriculture has been furnished with the reports of the Chemists of the above-mentioned factories for the week ending February 24, 1917. From these the following figures have been extracted to show the work that is being accomplished during the present season. In considering these figures, particularly the amount of canes ground, it must be remembered that the factories had only just commenced operations for the present season.

At the Antigua factory sixty-six hours were lost owing to stoppages.

	Antigua.	St. Kitts.
Canes ground	3,885 tons	5,620 tons
Canes per hour	31 „	40.4 „
Total sugar made and in process	396 „	627 „
Tons of cane per ton commercial sugar	10.20	8.96
Sucrose per cent. of cane	12.38	12.42
Fibre per cent. of cane	18.48	13.94
Moisture per cent. megass	45.33	45.95
Juice extracted per cent. of cane	69.73	77.65
Juice lost per cent. of fibre	35.82	32.3
Per cent. of indicated sucrose in juice recovered	87.42	90.55

MANURING OF COCO-NUTS.

The experiments in manuring bearing coco-nut palms undertaken by the Porto Rico Agricultural Experiment Station in 1912 are being continued and are said to be yielding valuable results. According to a recent report, while the application of fertilizers resulted in but little increase in the yield of nuts during the first two years in which the experiments were in progress, marked gains in yields have been recorded during the past year (1915) for plots given a complete fertilizer; that is, a mixture containing 6 per cent. nitrogen, 8 per cent. phosphoric acid, and 12 per cent. potash. Where 10lb. per tree was applied, a gain of over 30 per cent. in yield of nuts per tree over the checked plot was obtained, and where 20lb. per tree of the same material was applied, a gain of nearly 60 per cent. was noted. Where nitrogen or potash was omitted from the mixture, no increase in yield was recorded, and where potash was omitted, there was only a slight increase.

In connexion with the Porto Rican results given above, the following results of manurial experiments conducted on coco-nuts at Pinneys estate in Nevis should prove of interest. The first year's results, namely for 1914-15, were published in the *Agricultural News* (Vol. XIV, No. 355, p. 398). The following are the results obtained during the year 1915-16, and they indicate very considerable increases from manurial treatment. It should be mentioned that the estate is situated on good soil—old sugar-cane land—near the coast on the leeward side of Nevis. It is interesting to note that unlike Porto Rican experiments, in these, increased yields were given from manuring even during the first year. The increases for last year are much greater, however.

No. of experiment.	How manured.	Nuts on trees at end of expt. 1st.	Average per tree.	Nuts collected during year.	Average per tree.	Nuts left on trees at end of 2nd year's experiment	Average per tree.
1	No manure	600	21.4	686	24.5	591	21.1
2	Pen manure, 8 baskets per tree	960	34.2	1,014	36.2	853	30.4
3	Tankage, 8 lb. per tree, none applied this season.	753	27.8	922	34.1	824	30.5
4	8 lb. basic slag and 4 lb. sulphate of potash per tree	596	23.8	694	27.7	739	29.5
5	4 lb. sulphate of ammonia per tree	588	24.5	742	30.8	944	39.3
6	4 lb. sulphate of ammonia, 4 lb sulphate of potash, 8 lb. basic slag per tree	819	31.5	983	37.3	1,033	39.7
7	8 lb. basic slag per tree	654	24.2	791	29.2	926	34.2
8	8 lb. cotton-seed meal per tree	838	32.2	996	8.3	1,007	38.7

The manures were applied on October 7, 1915, and the experiment was brought to a close on October 6, 1916.

Once every month the plots were gone over and the fallen nuts counted and recorded, and the nuts collected.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADE. Mr. J. C. Moore the Superintendent of Agriculture, in his report for December and January states that these months had been particularly busy ones in the Botanic Gardens, with the resowing of lime seeds to replace wholesale losses through the 'damping-off' of first batches, and draining land and laying it out in specially prepared beds for the transplanting of lime seedlings. Dry weather in January necessitated much watering of the transplants, which are promising good growth. Arrangements have been made for raising 30,000 lime plants. The temporary facilities for drying about 80 bushels of seed-corn proved satisfactory, but involved considerable labour. It is proposed to store the whole amount of corn in one bin. A germination test of seed from the bottom of the bin on January 1, gave good results: germination in four days, vitality = 96 per cent. A special gauge for taking samples of corn from any part of the bin (which is 7 feet 4 inches high by 4 feet by 4 feet,) has been devised. The bin is so constructed as to admit of fumigation from below by hydrocyanic acid gas, or by carbon busulphide from the top.

Regarding staple crops, the condition remained normal: the reaping of the lime crop had been completed. The weather during these two months was seasonable, the rainfall being well distributed.

ST. VINCENT. During the month of February the picking of cotton in the Experiment Stations was completed and the old stalks pulled up. Operations also included the replanting of arrowroot manurial plots, sowing of different varieties of beans, peas and tomatoes, and a plot of alfalfa. Plant distribution was as follows: *Gliricidia* cuttings 800; grafted *Bougainvillea spectabilis* plants 2; miscellaneous plants 19. In the Botanic Gardens the work consisted of repairing walks around the Lily pond and central walk leading up to Government House gates; the Lily pond was cleaned out and *Nymphaeas* replanted. General work in the cutlassing of ornamental borders and around plants was also done. As regards staple crops, Mr. W. N. Sands the Agricultural Superintendent states, there was little to report: reaping operations were in progress generally: some growers had already started pulling up and burning old cotton stalks. Special work included visits by the Agricultural Superintendent to certain places in the Leeward district where the destruction of the food-plants of the cotton stainer was being carried on. The Assistant Agricultural Superintendent, Mr. S. C. Harland, was busily occupied in compiling the results of experiments with Sea Island cotton during the past season.

Two meetings of the Cotton Growers' Association and Agricultural and Commercial Society were held during the month to discuss matters in connexion with (a) a meeting of the Associated Chamber of Commerce for the West Indies, since held at Trinidad, and (b) telegrams received from the Fine Cotton Spinners. At the first meeting (held on February 7) the Agricultural Superintendent was unanimously elected as a representative of the Society to attend the above mentioned meeting, and he left for Trinidad on February 23. The weather was seasonable—rainfall at the Botanic Station 4.55 inches, and at the Experiment Station 3.85 inches.

DOMINICA. The Curator Mr. Joseph Jones, describes work in the Experiment Stations during the month of February, of a general routine character. Plant distribution included 3,010 limes, 200 shade trees, 12 cacao, 3 grafted mangoes, and 37 miscellaneous. In the Botanic Gardens,

in addition to routine work, a fence 225 feet long of reinforced concrete pillars on a concrete base was built on the southern boundaries of the gardens. Touching staple crops, there was a good flowering of lime trees during the month. The local price for lime products remained unchanged. Applications for some $\frac{3}{4}$ -million cane plants were received by the Government from planters and peasants. A first consignment of about 50,000 plants were received during the month from Guadeloupe and distributed on the Leeward coast. Under the head of special work, Mr. Jones states that samples of a number of the chief garden crops were analysed in the laboratory and their feeding values ascertained. In addition two cases submitted by the Customs authorities were dealt with, a sample of sheep manure was analysed, and a number of samples of lime juice sent in by planters were tested. The rainfall for the month was 4.10 inches.

MONTSERRAT. According to Mr. W. Robson the Curator, routine work in the Experiment Stations during the month of February has included the manuring of cane plots, cutting and distributing cane cuttings, trimming hedges, etc. The 16,000 bay trees in beds required constant watering. Plant distribution comprised the following: cane plants 1,100, cassava cuttings 1 800, *Saccharum ciliare* from pots 220, cowpeas 12 packets, and 4 packets papaw seeds. In the Botanic Gardens spraying was followed up on the lime experiment plot, and it was noticed that the shelter provided by the pigeon peas had on that section resulted in the trees showing some immunity to scale insect attack. Four distillations of bay leaves were made. The Chateau plot, says Mr. Robson, has never previously been in such a vigorous condition. A plot of Ajowan is now very promising.

As usual the destruction of old cotton plants has, on the whole, been effectively carried out as specified by law and planting of the new crop will commence as soon as favourable weather prevails in March. At the middle of the month 300 bales of last crop were shipped. The feverish haste of the small growers to get cotton land ready for planting is an indication of the popularity of the crop as a cultivation, and is largely the result of the better prices paid for seed-cotton in the past season. The Curator is of opinion that to make the industry quite stable, as far as the small growers are concerned, it would seem to be very desirable that some system of co-operative buying of their cotton should be started. Germination tests on cotton seeds have been carried out for a few estates. Orders have been received for 270 lb. of onion seeds compared with 390 lb. in 1916. Three boars and one sow of the Berkshire-Poland China breed have been imported for private owners. Remittances having been made from Canada for the onions shipped there in 1916, the affairs of the Montserrat Onion Growers' Association for that year have been wound up, and the final bonus paid to members. A report on the year's working was prepared for publication and distribution. Shipments of onions were made during the month to Guadeloupe, Trinidad, Dominica, and Barbados. Mr. Robson mentions that the approved estimates for the financial year 1917-18 provide for the appointment of an Assistant Curator for the island, chiefly with a view to greater attention being paid to peasant instruction. The rainfall for the month registered at Grove Station was 2.93 inches, the largest measurement being 64 parts, on the 27th.

ANTIGUA. Mr. T. Jackson in his report for the month of February states that plant distribution included 4,314 sisal, 123 coco-nuts, 5 decorative, 11,952 cane plants, 22 packets seeds, and 40 lb. of yams. Work in the Botanic Gardens as also in the Experiment Station was of an ordinary routine

nature. It is believed that approximately 3,000 new cane seedlings will be raised. In regard to staple crops, it is stated that Gunthorpes and a number of muscovado factories commenced grinding during the month. At the time of writing the onion crop was being rapidly harvested. The planting of a sisal plantation has been commenced in the windward district of Antigua. It is estimated that sufficient material can be obtained during the next six to eight months by the Agricultural Department to plant from 30 to 50 acres of this crop. Onions were attacked by thrips: these insects are said to be hastening the maturing of the crop. Onions shipped during the month amounted to 460 crates, and approximately 1,200 are in the onion house ready for shipment. The rainfall for the month was 2.33 inches; for the year, 4.56 inches. Rain is badly required at the present moment.

ST. KITTS. In his report for the month of February the Agricultural Superintendent states that in the Experiment Station the picking of cotton from the experiment plots was completed and the cotton bushes were being pulled up, while in the Botanic Gardens routine work was carried on, much watering having to be done in consequence of dry weather. Plant distribution included 2,300 cane cuttings, and 1,090 lb. selected cotton seed and 393 lb. yam sold. In connexion with the staple crops, Mr. Shepherd states that the reaping of the cane crop was proceeding rapidly, the canes ripening up with the high winds and dry weather. There have been many large cane fires in the Valley district which will mean some loss, as it was impossible to cut all the burnt canes before they began to spoil. The young cane crop is being supplied, but the canes are very backward owing to bad germination from the dry weather of December and January. Grasshoppers are making their appearance and doing some damage. The old cotton crop is all off: sales have been received from England at 3s. 2d., and much cotton has been sold locally at 2s. 9d. The demand for best selected seed is very great, and all available from No. 342 has been bought up. The rainfall for the month was 2.82 inches; for the year 4.55 inches.

Appended to this report is a summary of work conducted at the Government Laboratory during February: this included analyses of ten samples of milk received from the Inspector of Police; sweet potato meal (feeding value); velvet beans (feeding value); white bean meal (feeding value); sheep manure, basic slag, sulphate of ammonia, slaked lime, vanilla pods, and soils.

ONION GROWING IN ANTIGUA.

Onion growing in Antigua is a well established industry, and a co-operative system of marketing has been in operation for several years. One looks to Antigua therefore for information on the subject of this cultivation in the West Indies. The following notes appear in the Report on the Antigua Agricultural Department for 1915-16. In connexion with the interesting remarks concerning seed, the possibility of storing onion seed over calcium chloride occurs to us as being worthy of consideration:—

The area under this crop amounted to approximately 80 acres. From this area 6,913 crates of onions were exported. In addition to these, fairly large quantities were sold and consumed locally.

The season, as a whole, was too wet for this crop. Fairly large quantities of seedlings were lost in the seed-beds, and the extremely wet weather experienced during the latter end of the year caused large quantities of onions to rot in the soil.

The loss in the seed-beds was due to 'damping-off' fungus. The following measures, which may help to prevent a repetition of the trouble, ought to be adopted by planters:—

1. Beds should be of good soil and well drained.
2. The subsoil from the drains should not be put on the beds.
3. Seeds should not be sown thickly. This point is of great importance.
4. Water should be applied thoroughly, and only when required.

The following figures may be of interest; they show the number of crates of onions shipped during the past ten years:—

1906-7, 2,221; 1907-8, 1,934; 1908-9, 661; 1909-10, 3,149; 1910-11, 2,749; 1911-12, 4,337; 1912-13, 4,406; 1913-14, 6,557; 1914-15, 6,571; 1915-16, 6,913.

EFFECT OF THRIPS AND HEAVY RAINS.

During the year a $\frac{1}{10}$ -acre plot was planted with onions. These grew well and looked promising until early in the month of February. Soon after it became apparent that very little produce would be reaped from the plot.

Examination of the plants revealed that the young bulbs were deeply set in the ground and a large proportion of the roots had decayed. The weakened condition of the plants left them easy victims of an attack of thrips.

The soil on which these were grown was of a clayey nature, and the conclusion arrived at was that the particularly heavy rains experienced in December and early January buried the bulbs and roots of the plant so deeply that their normal functions were restricted. To prove whether this conclusion was correct or not, the soil was removed from the necks and tops of the bulbs of some plants which were not so advanced as those attacked; these matured normally. The point of importance in connexion with the foregoing is that the cause of the trouble was probably not directly due to thrips, but to the circumstances described.

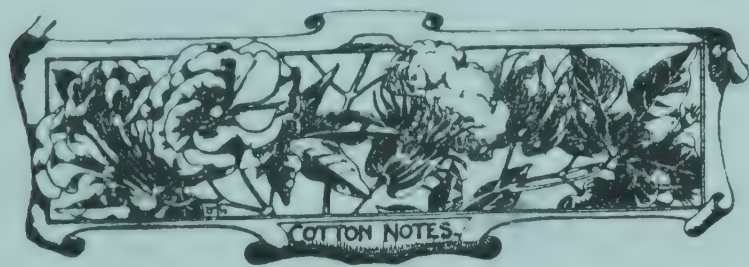
SEED RAISING, ETC.

It is well known to West Indian onion growers that excellent prices can be obtained in practically all markets for onions produced in January, February, and early March. It had however not been possible for the Antigua grower to get a large proportion of his crop into the early markets, on account of the seed from which it is raised not arriving before August.

Attempts were made to get over this difficulty in the year 1913, by saving seeds from one season to plant early during the next, and experiments were laid out to test the keeping qualities of onion seed. These proved that seeds could be kept in the tropics with a fair amount of success for about six months, after which they rapidly deteriorated. This was not sufficiently long to be of practical value.

During the year attempts were again made to get over the difficulty. In the first place a number of onions were kept for two months in an airy room and then planted to see if seeds would be borne. This was a failure, for each bulb instead of forming seeds divided and formed from five to eight medium-sized bulbs. Although failure to raise seed by this method must be recorded, yet the results of the experiment are significant, and it may be that early onions can be obtained in Antigua by the simple method of saving for two or three months large onion bulbs, and then planting them. Further trials of a similar nature will be conducted next season and fully reported on.

An attempt was made to grow an early crop from sets kept in a cool house until April; this however proved a failure.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland, of Liverpool, write as follows, under date February 5, 1917, with reference to the sales of West Indian Sea Island cotton:—

Owing to the absence of stock, no business has been reported in West Indian Sea Island cotton since our last report, but the market for Sea Island cotton is firm at previous prices.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ending February 24, 1917, is as follows:—

ISLANDS. The sales of the week consisted of 74 bales Extra Fine odd bags at 53c., and some small lots on a basis of Fine at 50c. The crop has been nearly all disposed of, there being left unsold only several Planters' crops of Extra Fine held at 55c. to 70c., 140 odd bags Extra Fine held at 53c., and some small lots of tinged and stained cotton. The buying continues on account of the Northern Mills.

We quote:—

Fully Fine to Extra Fine	53c. = 55c. landed
Fine	50c. = 52c. „
Fine, slightly off	48c. = 50c. „

GEORGIAS AND FLORIDAS. The demand has continued both in Savannah and in the interior markets, resulting in large sales aggregating upwards of 2,500 bales, on account of the Northern Mills. This demand following the large sales previously reported, estimated during the past fortnight at about 10,000 bales, has rendered holders firmer in their views and unwilling sellers except at an advance of 1c. over prices previously paid. The unsold stock yet to be disposed of, is estimated at 15,000 bales to 20,000 bales, which is firmly held in strong hands. The impression is that it will all be required by the mills in this country before the next crop comes to market as Egyptian cotton is relatively dearer and difficult to import.

We quote, viz:—

GEORGIAS AND FLORIDAS.

Extra Choice to Fancy	50c. = 51½c. landed.
Extra Choice	49c. = 50½c. „
Choice	48c. = 49½c. „

The exports from Savannah for the week were, to Northern Mills, 2,172 bales, Southern Mills, 357 bales, and from Jacksonville to Northern Mills, 521 bales.

BRITISH COTTON GROWING ASSOCIATION.

The One Hundred and Fifty-sixth Meeting of the Council was held at the Offices, 15, Cross Street, Manchester on Tuesday, February 6. In the absence of the President (The Rt. Hon. The Earl of Derby, K.G.), Mr. J. Arthur Hutton occupied the Chair.

It was reported that the President of the Board of Trade had arranged to receive a deputation representative of the Lancashire cotton trade on Thursday morning the 8th instant, with regard to the cotton situation generally.

It was reported that the Association had recently given 2 bales of African cotton to a Gift and Auction Sale which was held on January 24, in aid of the Lancashire Permanently Disabled Soldiers' and Sailors' Homes, and that these bales had realized nearly £1,000.

WEST AFRICA. Practically the whole of last season's cotton has now been shipped, and the Association are endeavouring to arrange for the shipment of a quantity of cotton seed, of which there are several thousand tons at the ginneries.

As regards the terminal facilities at Lagos, the Government have decided to reverse the decision arrived at in 1913, and to make the railway terminus and ocean steamer wharf at Apapa instead of at Vilmot Point. Pending the dredging of a 26 feet channel to Apapa from near Five Cowrie Creek, the Apapa Wharf is being extended so as to accommodate the branch steamers as well as the Harbour Moles stone traffic, but it is hoped that the full extension of 945 feet will be completed by the time that the channel to it has been dredged. A new dredger for the purpose has been built and is being sent out to Lagos.

The final purchases for cotton in Lagos for the year 1916 amounted to 9,286 bales, and in Northern Nigeria to 10,746 bales, making a total of 20,032 bales, and satisfaction was expressed that the total crop in Nigeria had for the first time exceeded 20,000 bales.

During the month of January this year 46 bales of cotton were purchased in Lagos, as compared with 155 bales in January last year, and 36 bales in January 1915. In Northern Nigeria 1,060 bales were purchased for the four weeks ending January 27, as compared with 1,485 bales for January last year, and 24 bales for January 1915.

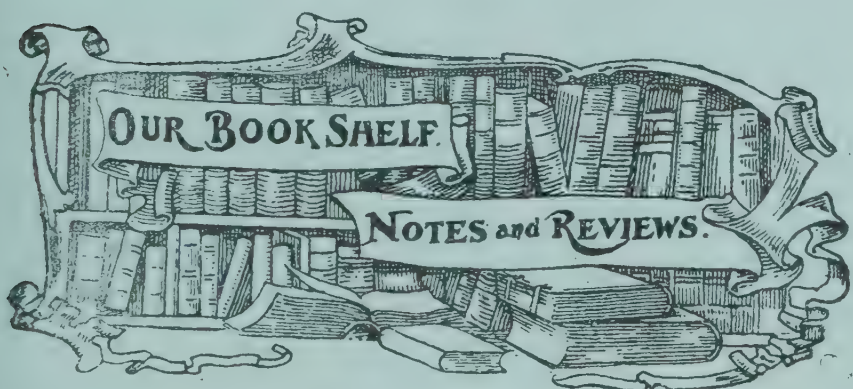
UGANDA. The transport difficulties in the interior of Uganda are practically over, but there is still great difficulty in obtaining space on the ocean steamers. The new cotton crop has suffered from unfavourable climatic conditions, and the Association's local manager now estimates the crop at 30,000 bales, as compared with his previous estimate of 40,000 bales. It was mentioned that during the quarter ending September 30, 1916, 1,455,449 lb. of cotton, produced in the East Africa and Uganda Protectorates, were exported to the United Kingdom, and 1,403,092 lb. to India and Burma. The cotton is most seriously wanted in Lancashire, but unfortunately the heavy rates of freight now demanded by the British Steamship Companies for bringing the cotton to this country are acting as a most serious handicap to the Lancashire Cotton Spinners. Under present conditions the Bombay Spinners are able to buy Uganda cotton on much more advantageous terms than Lancashire, but the opinion was expressed that this was only temporary, and in the long run it will be found that Liverpool was the best market for Uganda cotton.

NYASALAND. Letter from the Director of Agriculture was read expressing regret that the native crop of the river districts has suffered so much from frost in the middle and

latter part of July, that the expectations formed in the early part of July will not be realized, and the crop is not likely to exceed 800 tons. Never in the whole history of Nyasaland has frost been so severe, and in the South Nyasa and Ruo districts cotton plants were killed outright and the leaves were as brown as tobacco. The frost is estimated to be responsible for the loss of at least 200 tons of seed-cotton.

The question of transport to all districts is causing very great trouble, but, by co-operating with the military, the Director of Agriculture hopes to be able to keep the industry up to the standard of the last few years, and if the weather is favourable, to show a little progress.

GOVERNMENT WAR LOAN. It was decided that the Association should subscribe for an amount of the new Government 5 per cent. War Loan, and the total subscribed by the Association and the staff now amounts to £16,845, of which £14,495 is new.



CHEMICAL CONTROL IN CANE SUGAR FACTORIES. By Dr. H. C. Prinsen Geerligs. Revised and enlarged edition. London: Norman Rodger, 1917. Pp. 140. Price 10s. net.

The original edition of this manual appeared under the title of 'Methods of Chemical Control in Cane Sugar Factories', in 1905. Since then many advances have been made in chemical control. Data regarding the sucrose and the fibre contents of the cane are almost universally collected by indirect methods from the proportional amounts and the analysis of the juice and the megass, and not by the direct analysis of samples of cane. Thus the percentage of fibre is no longer determined by direct digestion or extraction, but is calculated from the difference between the total dry substance and that of the residual juice still left in the megass.

The necessary analyses and determinations, and methods of calculation for modern control are described in detail in this book, and the arrangement is very systematic and clear. The book may be regarded as a standard manual for central factories. Dealing almost entirely with methods of analysis and avoiding all theoretical discussion, it will be found especially useful by assistant analysts concerned principally with routine determinations.

In a summary of items of departmental interest recently received from St. Lucia, the Agricultural Superintendent mentions that the extension of the Government Lime Juice Factory has almost been completed. A new leaflet, No. 10, entitled 'The Cultivation of Vegetables in St. Lucia', has been prepared by the same officer and submitted for early distribution.



CONDITIONS IN THE BELGIAN CONGO.

The German occupation of Belgium has not had any material effect upon the administration of the Belgian colonies. War conditions, however, have resulted in a decline of the imports into the Belgian Congo; on the other hand, the exports show a decided increase. The English *Board of Trade Journal* for December 7, 1916, gives the quantities of the principal commodities of domestic production exported from the Belgian Congo in 1915, as compared with 1914, as follows:—

	1914.	1915.
	Kilogs.	Kilogs.
Cacao	482,360	619,819
Gum copal	6,993,063	4,265,653
Ivory	294,520	200,899
Palm kernels	8,052,176	11,023,903
Palm oil	2,498,386	3,407,093
Rice	422,237	1,139,901
Rubber	2,223,712	2,013,157
Salt	114,676	234,372

Kilog. = 2·2046 lb.

The above-mentioned Journal states that in connexion with the foregoing, the following summary of a speech recently delivered by the Governor-General of the Belgian Congo may be of interest. The summary is taken from a report published in the 'XXe Siècle' (Havre) of November 18, an extract from which has been forwarded by H.M. Minister accredited to the Belgian Government:—

The Governor-General is reported as having said that in spite of the financial strain imposed by the war, the Colony continues to prosper, and the revenue is expected to show a surplus of 8,000,000 frs. over the estimates in the current Budget.

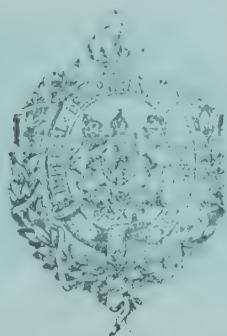
MINERAL INDUSTRY.—The working of the gold fields at Kilo and Monto has progressed, and the yield has exceeded expectations. Diamond prospecting in the bed of the Kasai River has been profitable; during the last two years important finds have been made. The copper mines and works have been exploited intensively in order to profit by the favourable market for this metal. During the second half of 1915 the three furnaces in service produced 6,914 tons of copper and 173 tons of matte.

AGRICULTURE.—The rise in the price of rubber has revived the interest of buyers in the Congo product, the value of which had depreciated during 1914. The production of palm oil in the Haut-Congo increased from 219 metric tons in 1914 to 1,425 tons in 1915, while the output of palm kernels increased from 1,160 tons in the former year to 4,994 tons in the latter. Rice cultivation is developing in the Colony, the harvest in 1915 amounting to 5,000 tons, permitting of the exportation of about 1,140 tons. Cotton is being planted, and there are good prospects for the development of coffee, cacao and manioc cultivation.

Metric ton = 2,204·6 lb.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number deals with the food value of the Canavalias, and of an interesting cereal known as the cultivated form of Job's Tears.

Important results regarding the manuring of coconuts are given on page 83.

Items of Local Interest in this issue will be found on pages 84 and 85.

Insect Notes, on page 90, deal with the sugarcane froghopper in Grenada.

Fungus Notes, on page 94, concern the cacao thrips fungus and new records of entomogenous fungi in Barbados.

Index to the 'Agricultural News'.

With this number of the *Agricultural News* is published, as a supplement, the title page and index to Volume XV.

The index should prove useful for purposes of reference on all matters relating to tropical agriculture, and will be a guide to concise but valuable information in regard to insect pests and fungus diseases of cultivated tropical plants, and their control.

The Growing of Asparagus in Dominica.

In the last issue but one of the *Agricultural News* (Vol. XVI, No. 387) was quoted a reference in an interesting old work entitled, 'Natural History of Nevis,' by the Revd. John Smith, to the growing of asparagus in that island.

An interesting letter has since been received at this Office from Mr. W. H. Porter of Dominica, in reference to the above, in which that gentleman states: 'It may interest you to learn that the plant [Asparagus] is being successfully grown at least in two places in this island at the present time without any special precautions. One of these places is situated at an altitude of 1,500 feet, the other is in Roseau; and, curiously, the shoots obtained in the town are as a rule better than those grown at the higher elevation. Within the last few days I have eaten asparagus gathered in Roseau that might have compared favourably with any to be obtained in temperate lands.'

Encouragement of Rice Cultivation in Trinidad.

Sir Norman Lamont, in presenting the report of the Committee on the encouragement of rice cultivation in Trinidad at a recent meeting of the Board of Agriculture, referred to the valuable help which its adoption would give in the difficult situation arising out of the matter of foodstuffs. The recommendations of the report include prize competitions, the introduction and distribution of seed, co-operative mills, irrigation, and utilization of Crown lands. As regards seed, it is recommended that 2 tons of a standard British Guiana rice be imported by the Board at an estimated cost of about \$80. It was also recommended that details as to best methods of cultivation be obtained and made known to cultivators. Concerning mills, as there are enough rice mills at present to deal with more than double the present crop, there appears to be no immediate necessity to recommend the establishment of a co-operative mill with a direct Government subsidy. Steps should however be taken to acquaint rice growers with the mode of working such enterprises which the future development of the industry may render desirable.

A full report of the matters referred to above will be found in the *Port-of-Spain Gazette* for Thursday, February 22, 1917.

Glasgow School of Sugar Manufacture.

From the *West India Committee Circular* for February 8, we learn that at a recent meeting of the Committee's Executive, it was decided to support the School of Sugar Manufacture of the Royal Technical

College of Glasgow, and that Messrs. Curtis, Campbell and Co. have headed the list of subscriptions with a contribution of £500, to be spread over five years.

The aim of the School is 'to provide for the sugar industry of the Empire a centre of training at least equal to those of Germany, Holland, France, and the United States of America; to render the industry less dependent upon men trained in foreign schools, and, with this intention, to give our men in our own country opportunity of acquiring a liberal education, with a knowledge of the agriculture, chemistry, and engineering of sugar manufacture, fitting them for responsible positions as managers, superintendents, chemists, and engineers. The School also aims at undertaking research work in association with the Government Board of Scientific and Industrial Research.'

It is satisfactory to learn that a definite move is being made in this direction, but we feel inclined to express the opinion that the whole matter is of sufficient importance to warrant consultation with colonial authorities on sugar production, manufacture and research. Chemical analysis and the manufacture of machinery do not constitute sugar manufacture and factory control, and there may be some people who will question the possibility of providing an adequate training for chemists, managers, engineers, and overseers and assistants, away from a central sugar factory itself. And there is the further consideration that some practical knowledge of cane cultivation, tropical labour, and systems of cane supply are needed by those responsible for the work of a factory. In other words, a committee of experts might consider it more desirable to establish a school in the tropics having a wider educational value than a school situated in an industrial centre in Great Britain could possess.

Hurricane Relief in Tortola.

Mr. W. C. Fishlock, Curator of the Experiment Station, Tortola, Virgin Islands, has forwarded to this office a copy of the report of the Hurricane (Food) Relief Committee, which was formed, under the chairmanship of Mr. Fishlock, soon after the disaster of last October. It is an interesting and instructive report reflecting great credit on the Committee, and on the other islands of the Leeward group who generously and speedily came to the assistance of their unfortunate neighbour.

The work of relief was apparently very well organized, and food was distributed extremely quickly and economically.

A supply of foodstuffs and clothing was received by the S. S. 'Chaleur' on October 16, and steps were at once taken to issue food relief. For this purpose persons in need were interviewed at the Experiment Station and their cases enquired into; in all genuine cases, suitable relief was given. This continued on the 18th, 19th, 20th, and 21st: the representatives of 347 men, 458 women, and 919 children, a total of 1,724, were thus supplied in the four days.

During this time arrangements had been made for dividing the Presidency into twenty-three districts, and in each centre an agent for the distribution of

foodstuffs was appointed. Commencing with the week ending on Saturday October 28, this system was brought into effect. Lists of the needy cases in each district had been prepared, and a dietary scale was made. Lists showing the names of each person or family to which food was to be issued, and the amount of the various articles of food to be issued to each were made and sent, with the necessary supplies, week by week to the various centres.

The Committee, speaking on behalf of the people, desire to express their deep appreciation of the kindness shown by His Excellency the Acting Governor in hastening to visit the Presidency immediately after the storm, and for his keen sympathy, shown in a practical way, by the measures for food relief he then initiated.

The value of the foodstuffs received from Antigua, St. Kitts, Montserrat, Dominica, and the supplementary purchases, have been placed at £497 10s. 6d. The cost of distribution, portorage, boatage, parcelling out and clerical work amounted to £26 13s. 2d., or 5.4 per cent.

A considerable quantity of clothing was also distributed.

It should be added that great generosity was shown by other West Indian islands outside the Leeward group. Thus in Barbados a special relief fund was started, and the Government itself voted £100. Similar generosity was shown by St. Lucia.

United States Rubber Supply.

While a retrospect of last year leaves no doubt that it has been the greatest year of the United States rubber industry, it gives rise, nevertheless, to some anxiety in the United States regarding supplies in the future. The *India Rubber World* (January 1, 1917) maintains that the future of the great American rubber industry, which uses two-thirds of the world's production of crude rubber, rests with the British Government. There is not enough Para rubber to supply the wants of the United States, even if every pound of it went there; and all the rubber grown in the Malay States, Ceylon, Sumatra, and Java is completely in the hands of England and Holland. Ex-President Taft, at the American Rubber Clubs' Seventeenth Annual Banquet advocated protection of American rubber interests abroad, and the development of rubber growing in America. He touched briefly upon American enterprise in the ownership and maintenance of rubber plantations in the Dutch East Indies and elsewhere, and emphasized the possibilities of the tropical and sub-tropical areas within their national jurisdiction. He thought more attention should be given to raising rubber in Texas and Mexico, and he referred to the lost opportunities in connexion with establishing an American rubber industry in the Philippines. There is no doubt, therefore, that at present the United States is entirely dependent upon foreign countries for its supply of rubber, more so even than Great Britain is dependent upon the United States for its supply of cotton. It is probable that in the future, interesting developments will take place in regard to foreign countries making every effort to secure and control their own supplies of raw material from the tropics as far as possible.



INSECT NOTES.

THE SUGAR-CANE FROGHOPPER IN GRENADA.

Froghoppers were first recorded from Grenada in 1895 by Uhler, under the name of *Tomaspis pictipennis*, but at that time they were apparently of no economic importance. In 1912 they were found on Para grass, and specimens were sent through the Imperial Department to the Board of Agriculture in Trinidad. Mr. Urich, the Entomologist, considered them to be different from the Trinidad species, then known as *Tomaspis varia*, and was of opinion that this insect might be capable of attacking sugar-cane. Towards the end of 1916, froghoppers were reported as doing considerable damage to sugar-cane on one estate.

Mr. C. B. Williams the Entomologist in charge of the froghopper investigations in Trinidad paid a visit to Grenada in December 1916, and the results of his investigations were subsequently published in a brief report. Mr. Williams, after comparing a number of the froghoppers from Grenada with the Trinidad species attacking sugar-cane, states that he can find no constant difference between them, and therefore the Grenada species must bear the same name as the Trinidad species, *Tomaspis saccharina*, Distant.

He found froghoppers either on sugar-cane or on grass in several different localities throughout the island, showing without a doubt that they had been established there for many years. Actual damage to the canes was reported from two estates, and on one of these the injury was fairly severe. In this instance three fields were attacked, two of these being badly affected, the third only suffering slight damage. Mr. Williams further points out that 'all the fields attacked were at a comparatively high altitude, 400-500 feet, on steep slopes and exposed to the East trade wind. They were strikingly different from the type of field most liable to froghopper attack in Trinidad.' Another point of interest in connexion with this outbreak is that the worst attacked field on this same estate had been alternately put under cane and pasture during the last ten years, and the two other fields had been under pasture for the same period and had only this year been put under cane.

Mr. Williams also found slight attacks of froghopper in low-lying fields in other parts of Grenada, but there was no injury to the cane.

From observations made by Mr. Urich in Trinidad, it has been noticed that the conditions most favourable to the development of the froghoppers are found in cane-fields where there is sufficient grass without an excessive amount of moisture. If, however, the surroundings are exceedingly dry, and exposed to wind and sun, the nymphs cannot surround themselves with a protection of spittle, and soon die; and on the other hand, if there is too much moisture, the froth becomes too

watery to suit the immature froghopper. It is also known that froghopper nymphs breed freely in lands which have been allowed to run to grass, and in this instance it would seem probable that the alternation of grass and cane, and the consequent difficulty of keeping the cane-fields clear of weeds and grass tend to produce conditions favourable to the development of the froghopper nymphs.

In Trinidad it has been recommended that cover crops be planted on ploughed land to keep down grass. It is not however, always practicable to plant a large area with cover crops, in which case a border of about 100 feet can be planted on abandoned fields adjacent to canes. In any case the practice of clean cultivation in and around the cane-fields will always help to keep down the numbers of froghoppers. The practice of heaping up the soil around the cane stools seems to be of doubtful value as a preventive measure against the froghoppers, since the soil while it remains encourages a growth of cane roots. When the soil is washed away by rains the exposed roots form an attraction for these pests. The mixing of lime with the soil heaped up around the stools seems to be of some value in warding off an attack, but can only be a temporary measure.

In the course of his investigations in Grenada, Mr. Williams made a careful search in order to ascertain whether any of the natural enemies which are proving so useful against the froghopper in Trinidad were also present in Grenada to the extent of serving as a means of control. He examined several hundred spittle masses without finding a single syrphid fly larva, so that they cannot be 'present in numbers sufficient to be of any value as a control.' The larvae of the syrphid fly (*Salpingogaster nigra*, Schiner) have come to exercise a considerable check on froghopper nymphs in Trinidad, owing to successful artificial breeding and distribution throughout the froghopper territory.

Another natural enemy of the froghopper in Trinidad, the green muscardine fungus (*Metarrhizium anisopliae*) has apparently not become sufficiently well established in Grenada to be of any value against the froghopper. One adult froghopper was found infected with the early stage of this fungus. Mr. Williams, however, took with him to Grenada some of the spore mixture of this froghopper fungus and distributed this over a part of the badly infested fields with the idea of starting a colony in Grenada. The results of this experiment will be awaited with interest.

As regards some of the other natural enemies of the froghoppers, it may be mentioned that spiders belonging to the family Attidae were scarce, and that only a few specimens of the predaceous grasshopper, *Xiphidium* sp., were found in the grass near the cane-fields. These grasshoppers apparently do not actually enter the cane plots.

The froghopper situation in Grenada need cause no alarm at present, but these insects will require careful watching. Such measures as weeding, the subsequent removal of the heaps of weeds from the cane-fields whenever possible, the burning or removal of trash, and the covering of resting fields with some kind of cover crop all contribute towards preventing the spread of froghoppers. As can be seen from the observations made by Mr. Williams, the natural enemies of the froghopper do not play a very important part in the control of this pest, and the time may come when the artificial introduction of some of these enemies from other countries will have to be undertaken. Meanwhile those that are already present should be encouraged in every way possible.

J.C.H.

DOMINICA HURRICANE LOSSES.

Shortly after the hurricane of August 28, 1916, the Administrator of Dominica approved of the suggestion to forward circulars to all planters in the island requesting information under various heads in order that the aggregate losses sustained by agricultural interests might be tabulated and recorded.

In all 120 circulars were sent out, and 95 answers were received. The thanks of the Agricultural Department are due to those planters who so kindly furnished the detailed information required.

Limes.—The figures show that the premier industry suffered considerably. This is to be expected, as lime trees are susceptible to overturning by wind, and even a gale may at times account for some damage in this respect. Fortunately the lime when blown over, exhibits, under sound treatment, great powers of recovery, and the actual loss by deaths owing to storms probably does not average more than 2 or 3 per cent. In the present instance, the high percentage of total loss in proportion to trees blown over is due to floods and landslides, and to some extent, to the effects of large forest trees falling upon the cultivations.

The number of lime trees totally lost on estates is stated in the returns to be 23,000, and those blown over, but likely to recover in the course of two or three years, reach the high figure of 83,000. These trees are planted at varying distances apart, but if we take an average of 200 per acre, this means that 115 acres of trees have been destroyed, and 415 acres blown down. The latter will recover in the course of several years, but their productive capacity practically ceases during that period.

The loss of crop is stated to be 118,000 barrels of fruit. Except in very sheltered positions, practically all the fruit, mature and immature, on the trees was blown off, and in turn much of this was swept away by the rush of water through the fields. Further losses were experienced owing to the difficulty of obtaining labour in emergencies of this kind. In spite of this huge figure, the crop of limes for 1916 only showed a decrease of 6,000 barrels of fruit when compared with the previous year's production. In this respect it was fortunate that a large proportion of the crop ripened before the end of August. As there has been no advance in the lime crop of Dominica during the past four years, observers confidently expected an increase of crop of close upon 100,000 barrels. This expectation was not realized owing to the hurricane. It is evident that a large increase of crop would have been recorded but for the adverse weather conditions.

Cacao.—The fact that much of the cacao cultivation on estates is grown in sheltered positions accounts for the comparatively light damage sustained. The number of trees lost is placed at 10,000, the damage in this instance being caused chiefly by floods and landslides. In this connexion several planters deplore the loss of wind-belts which are essential in certain localities. In many instances successful cultivation cannot be carried on without this form of protection. Many years must elapse before efficient wind-belts can be restored.

Minor Industries.—The loss in this case is comparatively small, and is returned as numbering 1,026 coco-nut trees, and 1,360 Para rubber trees. The set-back in neither case is serious.

Live Stock.—Under this head the returns show a small loss of £303.

Damage to Agricultural Buildings.—The total loss is returned at £2,047 10s. This comparatively slight loss shows that the hurricane experienced, although so disastrous

to lime cultivation, was by no means one of the highest intensity, such as sometimes occur in the West Indian islands.

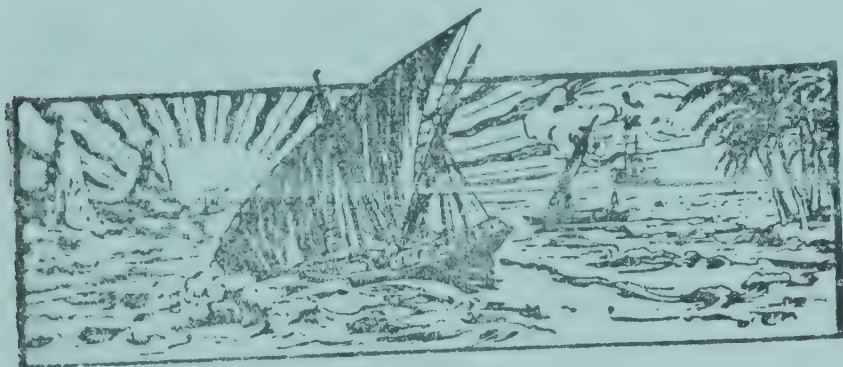
The above figures relate entirely to the losses on estates. Planters were asked to furnish information in respect to peasants' cultivation of limes and cacao in their immediate vicinity, and although much information came to hand, it proved impossible to form even an approximate estimate of the damage. That it has been considerable is undoubted, and if it could be expressed in figures, would form an important addition to the estate losses given above.

Peasants' gardens also suffered by rain, wash, and landslides but the root crops which are chiefly grown, are fortunately not affected to any great extent by high winds. That is, no permanent damage is done by the wind, the plants only receiving a check in growth, from which there is usually a quick recovery. Efforts are being made to assist this class by furnishing supplies of cane tops for planting. Enquiries have shown that there is a sufficiency of propagating material of other garden crops in all the districts.

The hurricane of August 1916 exerted the greatest intensity on a tract of country extending on the eastern side of the island from St. Sauveur in the south to Hatton Garden in the north, proceeding across the island, taking in the north end of the Imperial Road, and out on the western side between the Layou Valley in the south and Colihaut in the north. Fortunately in this section, the proportion of forest land to cultivated land is higher than in any other district of the island. Within this area lime estates suffered considerably, but north and south of this section the loss sustained was chiefly in crops and not to any extent in loss of trees. A point brought out in the two recent hurricanes is the amount of protection afforded by the high mountains and the gigantic ridges which buttress them. These are formidable enough to deflect the wind, and many estates escape practically undamaged in a hurricane owing to these natural defences, while other cultivations more exposed experience great damage. It would appear that nothing like wholesale destruction by hurricanes can happen in mountainous islands like Dominica, such as is known to occur in countries with a comparatively flat surface.

In Roseau, on both occasions, only a few heavy blasts of wind were experienced from the north-east; then came the calm period, lasting nearly half an hour. Following this the wind blew continuously from the south-west for half an hour, after which it came in powerful gusts, the interval between the gusts growing longer, and the force decreasing as the centre of the storm moved away. In other words, Roseau, owing to protecting hills, only experienced a little more than half of the force of the hurricane. Had the full force been felt from both directions, it is probable that properties in the district would have been considerably affected instead of escaping with little damage. The experience of the Chief Town in this connexion is typical of what happens in other districts. Generally speaking, the damage at Windward was caused by the wind from the north-east, and on the Leeward side, by the wind from the south-west.

Limes. Trees lost	23,100
„ Trees blown down	83,198
Barrels of limes lost	117,881
Cacao. Trees lost	10,180
Coco-nuts. Trees lost	1,026
Rubber. „ „	1,360
Live Stock. Financial loss	£303
Damage to agricultural buildings	£2,407



GLEANINGS.

It is stated in the *Colonial Journal* for January 1917, that the price of logwood last autumn had risen to £22 per ton, and of chips to £25; before the war the prices were £5 and £7, respectively. Extract was 2s. and 2s. 6d. per lb., having been 6d. before the war.

Thymol appears to be a valuable drug in the treatment of hookworm. In Jamaica the best results were obtained by making use of both thymol and oil of *Chenopodium* at a suitable interval. The Ajowan plant which yields thymol will grow satisfactorily in the West Indies.

Reference is made in the *Colonial Journal* for January 17, to the British occupation of German East Africa. Last October a branch of the Standard Bank of South Africa was opened at Tanga. It is understood also that German-grown sisal is now being shipped to Great Britain.

Flour standards are discussed in an article in *Nature* for January 18, 1917. It is advocated that instead of increasing the percentage of offal to be included in the flour, other cereals should be mixed with first grade wheat flour. In this connexion corn flour (maize starch) is advocated.

It is stated in the *Port-of-Spain Gazette* (Trinidad) that the British Government has approved of the use of kapok in the manufacture of life preservers, and that henceforth it is likely that this fibre will take the place of cork. Kapok is obtained from the silk-cotton tree (*Eriodendron anfractuosum*), commonly seen in the West Indies.

The death of Dr. N. H. J. Miller, of Rothamsted Experimental Station, is announced in *Nature* for January 18. Dr. Miller's chief work was the measurement of the amount of the combined nitrogen brought down in the rain, and of the amounts of nitric nitrogen washed out from the soil. Both measurements were indispensable for the settlement of important controversies in agricultural science.

An important article on tests of boilers with megass as fuel, appears in the *Louisiana Planter* for January 27, 1917. Tests were made at four different factories with the view to obtaining the amount of fuel consumed, equivalent evaporation, temperatures, horse power developed, etc. It is understood that the information referred to has been issued as *Bulletin* No. 160 of the Louisiana State University.

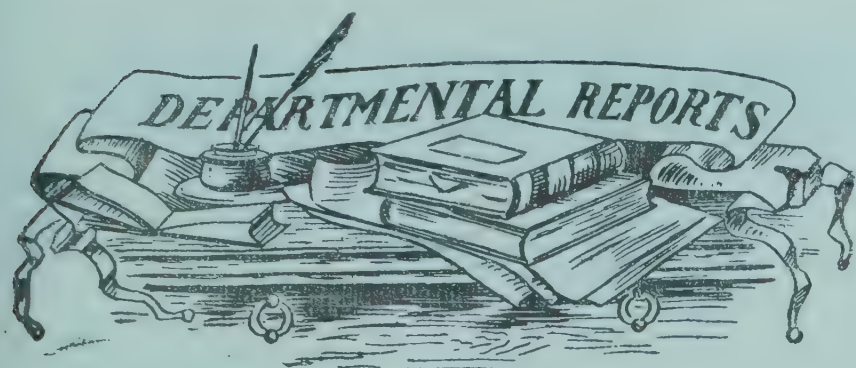
An article in the *Journal of Heredity* for February deals with bud variation in lemons. It shows the importance of careful selection of budwood for propagation. The low yield in some of the lemon groves of California is due to the propagation of the trees from buds of the 'shade tree' strain instead of from the productive strain trees. The article will be read with interest by those connected with lime cultivation in the West Indies.

According to the report of the Porto Rico Agricultural Experiment Station for 1915, efforts are being made at that station to raise some hybrid Vanillas, but up to the present no plants have been obtained from seed. Some very interesting results have been obtained relative to the desirable length for vanilla cuttings. It appears that every advantage lies with the longest cuttings. Experiments in the matter of liming, showed that vanilla plants receiving only small applications of lime grew much better than those to which large quantities were applied.

Reference was made in the last issue of the *Agricultural News* to the progress that is being made in connexion with the eradication of the native food-plants of the cotton stainer in St. Vincent. A further report (for February) has been received from the Agricultural Superintendent, Mr. W. N. Sands. Up to February 28, the total number of John Bull trees and silk-cotton trees that have been destroyed since the beginning of the campaign were 11,570 and 1,345, respectively. In addition, thousands of seedlings have been destroyed. The total expenditure up to February 28 was £257 14s 5d.

In *Forest Bulletin* No 33, dealing with an enquiry by the Government of India into the relation between forests and atmospheric and soil moisture in India, it is concluded that the results show that there has been no permanent change in the amount of rainfall over large tracts, either for the better or worse. Such evidence as is available in India points to the conclusion that the influence of forests probably tends to increase the rainfall, but not in any marked degree. The main rainfall in India depends on the monsoon currents, which are affected by conditions obtaining outside India, and not by any destruction or re establishment of forests.

The recent industrial development in South Africa is dealt with in the *Monthly Magazine* of the Incorporated Chamber of Commerce of Liverpool (December 1916). The export of beef from the Union continues, and recent reports indicate that a much better and more uniform class of meat is now being sent to the United Kingdom. As regards dried fruit, between 300 and 400 tons of Cape raisins were placed on the United Kingdom market in 1915. South Africa is making rapid progress in its export trade in citrus fruit, and it is expected that the production within the Union next year will reach about 1,000,000 boxes. No reference is made in this article to the production of sugar.



ANTIGUA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1915-16.

During the year under review the appearance of the Antigua Botanic Gardens was further improved on account of the good climatic conditions which were experienced during this and the previous year. Attention has been given particularly to the establishment of different species of *Bougainvillea*, and opportunity was taken to plant an avenue of the false sago palm (*Cycas circinalis*). In the nurseries, much work was done in connexion with the raising of cane seedlings and other plants, and the distribution of material for planting on estates. The following were sent out: 3,756 coco-nut plants; 2,257 eucalypts; 621 mahogany seedlings; 750 limes; 600 Agaves; 30,500 onion plants, and 254,617 cane plants. Besides these, a quantity of seeds and cuttings for provision crops were distributed. Several interesting plant importations took place, amongst which were the seeds of several species of indigo, and of *Tephrosia Vogelii*.

As usual, plot experiments were continued at the Experiment Station. A good deal has been done with varieties of sweet potatoes. From these plots, perfectly healthy cuttings of the best yielding varieties are rendered available for distribution in the island. Plant selection of sweet potatoes seems to show that in the case of the present year anyhow, selection has tended to reduce the yield. In other words, it would not seem to be worth while. Trials have been continued with Colombian, Montserrat, and Jamaican varieties of cassava. The Jamaican variety, White Top, seems, on the average, to be the highest yielder, but there is great variation in the yield given from year to year by all the varieties. Thus the Colombian variety, Negrita 18, gave a calculated yield per acre in 1915-16 of 12,870 lb., while the average yield per acre for ten years was only 7,198 lb. A considerable amount of work was carried out with Indian corn. This consisted of manurial experiments which have not yet given any conclusive results. The distance planting experiments have shown that, on the whole, slightly better results are obtained when a greater number of plants per acre are grown, though there does not appear to be as much advantage gained by very thick sowing.

Acclimatization and selection experiments with corn have been started. Much information is given in the report in regard to onions. The cultivation of this crop and its marketing on co-operative lines have become now an important business in Antigua. Some interesting notes are given in regard to attempts to make the onions fruit in order to get seeds. These were not successful, but it was thought possible to grow very early crops from sets kept in the cool house until April. This was not successful, however. A rather noticeable feature of the report this year is a small amount of information recorded in regard to experimental work with cotton. It is stated: 'work similar to that performed in previous years in connexion with the selection of cotton was carried out.' Information of local interest will be found in the section dealing with insect and fungus pests and their control.

As regards progress in the chief industries, the sugar crop—the principal staple—was not quite as satisfactory as in 1914; nor was cotton, the next most important crop for export. Weather conditions were not especially favourable. The small lime industry remains in very much the same condition. Interest in the cultivation of coco-nuts is being maintained. An interesting section of the report is that comprising notes on sisal cultivation. Some attention is being given to the cultivation of sisal in Antigua, and local data are available as to the yield likely to be obtained. Sisal gives 150 to 200 lb. per acre, and henequen 477 to 770 lb. of leaves. Taking the length of life of the sisal at eight years, and henequen at sixteen, we find one producing from 19 to 25 lb. of leaves per annum and the other from 28 to 48 lb.

Two lengthy statements appear on the Onion Growers' Association, and on the work of the Government Granary. The Onion Growers' Association had a successful year, and continued to expand in every direction. The Government Granary, now that the supply of local foodstuffs and their storage become more and more urgent, will be more largely patronized. Reference appears also to other associations, namely the Cotton Growers' and Lime Growers' Associations. Each of these has decided on definite policies and should be of value for the protection and growth of the industries concerned.

Miscellaneous matters to which attention may be especially directed in the report are the spraying or dipping of cattle for the control of ticks, which is now largely practised; the notes on reafforestation; the account of the maize show—the first of its kind in the West Indies,—and the note on peasant instruction—a new line of work for Antigua. This interesting report concludes with details of administration and a meteorological summary, from which it is seen that the rainfall for the year under review at the Botanic Station was 65.30 inches, or 25.30 inches above the average.

FOOD VALUES.

The Ontario Department of Agriculture has recently issued a Bulletin (No. 245) dealing with the economic utilization of foodstuffs in Canada. Dealing first with the chemical aspect of food values, in a similar manner to that which has already been followed in recent issues of the *Agricultural News*, the Bulletin then gives attention to more practical domestic aspects of the subject, including the cost of food and its real food value, the intelligent buying of foods, and economy in cooking and using fruit, vegetables, milk and meat. In regard to the intelligent buying of foods, the statement is made: 'learn the real cost—not how little did it cost, but how much real nourishment was secured with the money spent.' Another useful piece of advice is the following: 'Buy sparingly the foods which are produced more for their taste than their nourishment, e.g., many relishes and condiments, and imported canned articles.' Attention is also called to the advantage which can be derived from making a vegetable garden. Not the least useful part of this Bulletin is the section dealing with the methods of making bread in the home. It is believed that under most circumstances, making bread at home is more economical than buying it from the baker. Two methods are described: the long fermentation method, and the short fermentation method. It is stated that the latter requires the use of strong spring wheat flour.

FUNGUS NOTES.

PRELIMINARY TRIALS WITH THE
CACAO THRIPS FUNGUS.

Cultures of *Sporotrichum globuliferum*, obtained from parasitized thrips collected by Mr. W. N. Sands in St. Vincent as previously announced (*Agricultural News*, Vol. XV. p. 430), were forwarded in December from this Office to the Superintendent of Agriculture in Grenada for trial. Mr. Moore's report has now been received.

The first application was made by spraying the spores suspended in milk-warm water on to several suckers in the cacao plot at the Botanic Gardens. The weather conditions in the period which followed were considered to be too dry for successful fungus development, and the proportion of nymphs to adult thrips was very small. One thrips parasitized by the fungus was found four days after inoculation, but observations continued for a month failed to reveal the presence of any further examples.

The next trial was carried out on cacao plants in boxes, which in order to maintain a humid atmosphere were placed in a cotton-screened enclosure in the nursery. Thrips in all stages were introduced on the plants. Some days later, half the plants (2 boxes) were sprayed with the fungus spores. Soon afterwards (time not given) dead nymphs were observed on these plants, and twelve specimens were microscopically examined and found to be parasitized by the fungus. On the following day a careful count was made which showed 112 parasitized nymphs. Later a number of parasitized adults were found. Specimens of the dead insects were forwarded to the Imperial Commissioner of Agriculture, and the identity of the recovered fungus was confirmed by the writer.

The other two enclosed boxes were at the same time dusted with spores of the green muscardine fungus, *Metarrhizium anisopliae*. One adult thrips was found dead and covered with a greyish green fungus, but the specimen was lost before it could be examined.

It is proposed to repeat these experiments, and to make field trials in humid situations when the wet season infestation begins.

NEW RECORDS OF ENTOMOGENOUS
FUNGI IN BARBADOS.

In the course of a recent visit to one of the deep gullies which occur in the coral limestone of Barbados, the following fungus parasites of insects were collected by the writer: *Verticillium heterocladium*, on a species of citrus white fly, *Aschersonia (cubensis?)* on star-scale (*Vinsonia*), and *Ophioneutria coccicola* on purple scale (*Lepidosaphes*). All occurred commonly on the leaves of lime trees growing on the floor of the gully.

The first species, which is the one known as the cinnamon fungus in Florida, does not appear to have been previously recorded in the West Indies south of Porto Rico. The second is common in the wetter islands; it has been known to the writer in its present situation in Barbados for three or four years, and is rather effective as a parasite. The third species is common, and very useful in Dominica and St. Lucia, and occurs in Grenada and St. Vincent. This appears to be the first record of its presence in Barbados.

W N.



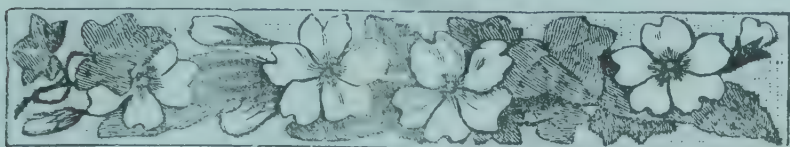
Growing Canavalias for Food in the West Indies.—Considerable West Indian interest is being shown in the cultivation of various species of beans of the genus *Canavalia*. Both *C. gladiata*, the Sword bean, and *C. ensiformis*, the Horse bean, are valuable green dressings, and there is no doubt that both these beans could be made use of for food purposes. At present they are regarded with some suspicion on account of the existing notion that these beans are poisonous or wholesome. In Porto Rico a trial has been made with *Canavalia incerva*. This bean is cultivated as a vegetable in a number of Asiatic countries but its growth has been poor in Porto Rico compared with that of the brown- and purple-seeded types of *C. gladiata*, or white-seeded *C. ensiformis*. In regard to the cultivation of this latter species in the British West Indies, Mr. A. J. Brooks, Agricultural Superintendent, St. Lucia, states that it is very desirable that the question of the poisonous character of these beans should be cleared up definitely, as the plant is capable of supplying a large quantity of food material in St. Lucia. The same holds good in the case of other islands too. It may be pointed out that the wholesome character of *C. gladiata* has been definitely established both in Barbados and Trinidad, where this bean has been regularly consumed by several well-known residents. There is little doubt that the reputation which *C. ensiformis* bears in the popular mind is equally unfounded; in fact most of the published statements make definite reference to the wholesome nature of this particular bean. Mr. Brooks's notes concerning cultivation are as follows.

Sown 2 feet apart under favourable conditions an acre will produce 10,000 good plants bearing an average of twelve pods each. Each pod contains an average of from ten to twelve large beans. On rich land, sixteen to twenty beans per pod have been obtained.

The average yield per acre is something over one million mature beans weighing, when thoroughly dried suitable for manufacturing into meal, 4,000 lb. per acre.

The plant when cut at flowering period and before pods have commenced to form, has during extended trials at Réunion given 16 tons of fresh green manure per acre exclusive of roots, the plants being chopped down with hoes.

The different economic uses and possibilities of the seaweeds are dealt with at length in the *Journal of the New York Botanical Garden* for January 1917. The statement is made that, assuming that two crops a year of kelp could be harvested on the California coast, a return of 59,300,000 tons of fresh kelp, equivalent to 2,266,000 tons of potassium chloride could be obtained. It is maintained that the giant kelps of the Pacific Coast, harvested to a depth of 6 feet, could perennially yield an annual output of potassium chloride about six times the equivalent of the potassium salts now imported into the United States. Besides their use as manure, the seaweeds are used for a variety of other purposes in different parts of the world. They yield iodine, and in Japan and Hawaii they form an important item of the diet of the people. Other seaweeds are used as a source of glue.



WEST INDIAN PRODUCTS.

DRUGS AND SPICES IN THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market, for the month of February 1917:—

There has been but little or no change in the condition of business, either in extent or variety, in the London Produce Markets since our last report for the concluding month of the year 1916. The holiday season always has a depressing after effect on business activities, and taken in conjunction with the war time depression, our report for the first month of the year 1917 will necessarily be brief.

GINGER.

At the first spice auction on January 3, ginger was represented by 304 bags of plump limed Japanese, all of which were bought in at 42s. 6d. to 45s. per cwt.

SARSAPARILLA.

This drug was well represented at auction on the 11th of the month by 22 bales of grey Jamaica, 25 of Mexican, 6 of Honduras, and 5 of native Jamaica. Ten bales only of the grey Jamaica found buyers, 8 of which sold at 1s. 10d. per lb. for fair fibrous; 20 bales of the Mexican were disposed of privately; for the remaining 5, 1s. per lb. was asked but not obtained; the 6 packages of Honduras fetched 1s. per lb. for sea-damaged; 2 bales of native Jamaica fetched 1s. per lb.; the remaining 3 bales remained unsold.

CITRIC ACID, LIME OIL, CASHEW NUTS, CANELLA ALBA, ANNATTO SEED, KOLA, AND ARROWROOT.

At the beginning of the month citric acid had assumed a firmer tone at 2s. 7d. per lb., increasing a week later to 2s. 7½d., at which price it stood at the close of the month. There has also been good supplies of lime oil, the quotations for which at the beginning of the month were—for hand-pressed 13s. to 13s. 6d., and for distilled 8s. 6d. to 9s.; at the close of the month hand-pressed West Indian realized 14s. per lb., while 9s. was still being obtained for distilled. At the drug auction on the 11th of the month, the large consignment of 50 packages of Cashew nuts were offered, but none was sold. Ten packages of Canela alba bark were also offered at this sale but failed to find a buyer, the whole consignment being held at 75s. per cwt. for fair pale quill. It was noted at the time that the bark had been scarce in the market for some time past, and that sales had been made by druggists at prices varying from 75s. to 80s. per cwt. At the same sale Annatto seed was also in good supply, as many as 43 packages being offered but no buyers were found. A good deal of interest centred around the large supply of kola, which amounted to 200 packages, only 8 of which, however, found buyers, fair bright West Indian halves fetching 5d. to 5½d. per lb., and dull and part mouldy 4d. per lb. Toward the end of the month it was reported that some sales had been effected of St. Vincent arrowroot, at 3½d. per lb.

CONTROL OF TICKS IN THE WEST INDIES.

The spraying or dipping of cattle for the control of ticks has become general in Antigua.

There exist in the island at the present moment one large spraying machine and one dipping tank. The former appliance is erected at Tomlinsons estate; the latter at Bendals.

The length of the dipping tank is 60 feet, with a maximum depth of 6 feet and a width of 3 feet; the whole is constructed of concrete.

It is anticipated that another large spraying machine or tank will be erected on Gambles estate in the near future.

It has been found that the regular spraying or dipping of cattle not only frees the animals and pastures from ticks, but materially improves the health of the beasts subjected to such treatment.

The spraying solution used is Cooper's Cattle Dip. (Report on the Agricultural Department, Antigua, 1915-16.)

REAFFORESTATION IN ANTIGUA.

It is stated in the Report on the Agricultural Department, Antigua, for 1915-16, that during the year under review about 50 acres of the catchment area of Wallings reservoir was planted with forest trees.

Seeds of such trees as Mahogany (*Swietenia Mahagoni*), Walnut (*Andira inermis*), Mango (*Mangifera indica*), Spanish Ash (*Inga laurina*), Tamarind (*Tamarindus indicus*), Circassian Bead (*Adenanthera pavonina*), Jamaica Shade Tree (*Pithecolobium Saman*), etc., were collected and stored in charcoal until good weather for planting was experienced.

It will be observed that the seeds collected were nearly all seeds of large trees suitable for planting at stake.

The operation of planting was simple, the land being mostly covered with coarse grass and other dwarf herbage. Small areas about 1 foot square were in the first instance cleared with the hoe. Shallow holes were then made with a fork, and from three to five seeds planted in each. The distance between each lot of seeds was 8 feet.

The seeds germinated well, and if no untoward circumstance occurs, this work should in a few years' time influence the quantity of water flowing into Wallings during periods of drought.

The method adopted for reforesting this area was simple and efficient. Should similar work be contemplated in other places, it might be said that the success of such a venture depends to a very considerable extent on the type of seed chosen for planting. It is almost needless to say that the work should be commenced at the beginning of the rainy season, so that the young plants will be sufficiently advanced to stand the effects of the dry season when it supervenes. It might also be added that this method is much cheaper than transplanting young trees.

The reforestation plots planted some thirteen years ago by the Agricultural Department have made good growth. The trees in the plot situated to the north of the Botanic Station have made much better growth than those planted in the plot by the Camp. The latter, although containing poor shallow soil, demonstrates clearly that certain trees will grow in such situations.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
February 8, 1917.

ARROWROOT—2½d. to 4½d.
BALATA—Block, 2/6 to 3/3½; Sheet, 3/9.
BEESWAX—No quotations.
CACAO—Trinidad, 79/-; Grenada, 60/- to 71/6; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£45 10s. to £46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 34d. to 36d.
FRUIT—Bananas, £17 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, 62/6 to 72/6.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed) 14/6.
LOGWOOD—No quotations.
MACE—11d. to 2/6.
NUTMEGS—6½d. to 1/6.
PIMENTO—3½d.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, 4/4 to 4/9.

New York.—Messrs. GILLESPIE BROS. & Co., February 9, 1917.

CACAO—Caracas, 15c. to 15½c.; Grenada, 14½c. to 14¾c.; Trinidad, 14½c. to 14¾c.; Jamaica, 12½c. to 13c.;
COCO-NUTS—Jamaica and Trinidad selects, \$21.00 to \$22.00; culls, \$12.00 to \$13.00.
COFFEE—Jamaica, 10c. to 12c. per lb.
GINGER—15½c. to 18c. per lb.
GOAT SKINS—Jamaica, \$1.25; Antigua and Barbados, \$1.15 to \$1.25; St. Thomas and St. Kitts, \$1.00 to \$1.15 per lb.
GRAPE FRUIT—Jamaica, \$1.50 to \$1.75.
LIMES—\$5.00 to \$6.00.
MACE—41c. to 48c. per lb.
NUTMEGS—22c. to 24c.
ORANGES—\$1.50 to \$2.00.
PIMENTO—5¾c. per lb.
SUGAR—Centrifugals, 96°, 4.89c; Muscovados, 89°, 4.28c.; Molasses, 89°, 3.89c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., February 23, 1917.

CACAO—Venezuelan, \$14.00 to \$14.25; Trinidad, \$17.28 to \$17.76.
COCO-NUT OIL—\$1.45 per Imperial gallon.
COFFEE—Venezuelan, 12½c. to 14½c.
COPRA—\$7.25 per 100 lb.
DHALL—No quotations
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$8.40 to \$8.75; White, \$9.25 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., March 20, 1917.

ARROWROOT—\$5.00 per 100 lb.
CACAO—\$11.50 to \$12.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, \$112.00 per ton.
MOLASSES—No quotations.
ONIONS—\$4.50.
PEAS, SPLIT—\$10.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$8.55; Patna, no quotations; Rangoon no quotations.
SUGAR—Muscovado centrifugals, \$4.50.

British Guiana.—Messrs. WIETING & RICHTER, December 30, 1916; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	MESSRS. WIETING & RICHTER.	MESSRS. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	\$11.00	
BALATA—Venezuela block		
Demerara sheet	\$65.00	
CACAO—Native	16c. per lb.	
CASSAVA—	84c.	
CASSAVA STARCH—	\$9.00	
COCO-NUTS—	\$20 to \$24 per M.	
COFFEE—Creole	12c. to 13c.	
Jamaica and Rio	15c. per lb.	
Liberian	11c.	
DHAL—	\$6.50 to \$8.00	
Green Dhal		
EDDOES—	96c.	
MOLASSES—Yellow	None	
ONIONS—Teneriffe		
Madeira	7c. to 8c.	
PEAS—Split	\$12.00 to \$12.50	
Marseilles		
PLANTAINS—	32c. to 60c.	
POTATOES—Nova Scotia	\$5.25 to \$5.50	
Lisbon		
POTATOES—Sweet, B'bados	\$1.92	
RICE—Ballam	\$7.00	
Creole		
TANNIAS—	\$2.88	
YAMS—White	\$2.40	
Buck		
SUGAR—Dark crystals	\$3.40 to \$4.50	
Yellow	\$5.00 to \$5.10	
White	\$7.00	
Molasses		
TIMBER—GREENHEART	48c. to 72c. per cub. foot	
Wallaba shingles	\$5.50 to \$7.50 per M.	
„ Cordwood	\$3.00 to \$4.00 per ton	

NO QUOTATIONS.



A FORTNIGHTLY REVIEW OF THE IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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Efforts in Aid of Peasant Agriculture.

THE fact is frequently overlooked that a great deal of the work of agricultural departments is concerned with the improvement of peasant agriculture. In the West Indies the policy of assisting the peasant has been steadily pursued since the great depression in the middle nineties. The Royal Commission which visited these islands in 1897 put forward as a principal recommendation, that then

revival of prosperity was intimately bound up in the establishment of peasant holdings, and this resulted in the Land Settlement schemes which have proved so markedly successful in several of the islands. Naturally the task of giving instruction and guidance has fallen on the agricultural departments, and a great deal has been achieved in the direction of introducing sound systems of cultivation. In his Parliamentary report on the Land Settlement scheme in St. Vincent, the first to be started, Mr. Tatham in 1911 referred to the results as being of a ‘permanent and far-reaching character.’ ‘It would be difficult,’ the report states, ‘to over-estimate the progress which has been made through the efforts of the Agricultural Department. The officers of this Department have not only dealt with questions concerning the best methods of growing and handling different crops, but also with those of maintaining the fertility of the lands of the small holdings. Instruction has been freely given in the making of drains to prevent washing, by the formation of compost heaps and manure pens; the growing of leguminous and other plants for green-dressing purposes; the utilization of grass and bush as a mulch for permanent crops and arrowroot; the rotation of crops and pasture fallowing. The advice that has been received in these and other matters is producing a class of small holders which is a valuable asset to the agricultural progress of the Colony.’

St. Vincent was the first to adopt the scheme to which the foregoing refers. This occurred in 1899. Carriacou, a dependency of Grenada, followed in 1903, and in 1910 Grenada began on a modest scale which has been steadily extended since. In 1913 St. Lucia entered upon a definite policy also; and at the present time a Land Settlement scheme is under consideration in Dominica and Antigua. In the larger West Indian

colonies—British Guiana, Jamaica, and Trinidad—there exists a large class of peasant farmers for whom agricultural instruction is provided by the Government.

Out of this land settlement have arisen in the ordinary course of evolution certain schemes having for their object the introduction of various forms of co-operation. By way of illustration, mention may be made of the scheme under which the St. Vincent Government purchases peasant cotton and deals with it on a profit-sharing basis. This system, which was instituted in 1910 has now been in operation for six seasons, and may be regarded as highly successful. Quite recently a plant for extracting oil from cotton seed and for making cotton-seed meal has been installed. This meal provides valuable cattle food while the coarser qualities are used locally as manure. Another example is to be found in the assistance rendered by the Government of the same colony in regard to the provision of agricultural credit for the peasant. The Agricultural Credit Societies Ordinance, passed in 1913, has been responsible for the similar enactments in Trinidad and St. Lucia. Co-operative credit societies, founded on the Raiffeisen system are now working satisfactorily in St. Vincent, St. Lucia and Trinidad.

Associated with the Land Settlement policy are the various prize-holdings schemes which are calculated to do so much good in the direction of the improvement of peasant holdings. An extensive competition is conducted annually in Grenada and other colonies, and a scheme is now being arranged for in St. Lucia. These competitions are backed up by visits made by agricultural instructors, who offer guidance and advice in all matters pertaining to the betterment of the holdings.

Not directly connected with Land Settlement, but none the less important as efforts in aid of peasant agriculture, are the facilities afforded by Central Sugar Factories in regard to the purchase of peasant canes. Each of the Antigua factories, for example, has an agreement to purchase peasant canes on the basis of the value, at Antigua, of 4½lb. sugar (96° refiners' crystals) per 100lb. of canes delivered. These factories further agree to guarantee a minimum price. Many thousands of tons of cane have been purchased under this system.

Two other schemes which aid peasant agriculture must be referred to. One is the Government Granary schemes in Antigua and in St. Vincent, by which Indian corn is purchased or stored. The other is the Lime Juice Factory in St. Lucia, which

buys limes from the peasants, payment being partly in cash, followed by a bonus distributed at the end of the season, the amount being dependent on the prices at which the produce has been sold by the factory.

Added to the foregoing efforts to aid peasant agriculture, there is the usual routine nursery work at the Experiment Stations, which provides planting material especially for raising provision crops, and sugarcane and cotton. Thus it will be seen that a great deal has been and continues to be done on behalf of the peasant, the Governments exercising benevolent control and providing the necessary agricultural guidance and advice.

This policy of promoting the welfare of peasant agriculture is not always regarded sympathetically by the larger estate owners. In some quarters it is imagined that land settlement interferes adversely with the labour supply. But actually land settlement tends to operate in the opposite direction, and as is pointed out in an instructive paper in the *West Indian Bulletin** on Government Schemes of Land Settlement in Grenada, labour is improved in quality and quantity, not in spite of the fact that the peasantry are more independent, but *because* of it.

Mr. A. J. Brooks, Agricultural Superintendent, St. Lucia, in a recent communication states that His Honour the Hon. C. Gideon Murray, Administrator, was expected to leave the Colony about March 23. Mr. Murray is proceeding to France to take up service with His Majesty's forces. Mr. Brooks states that His Honour's departure can only be regarded throughout the island as an unfortunate setback to the agricultural progress of the colony, in which the Administrator took so great an interest.

VEGETABLE SEEDS IN THE TROPICS.

In connexion with the article that appeared in the *Agricultural News* of March 10, on the deterioration and methods of preserving vegetable seed in the tropics, Sir Gilbert Carter, K.C.M.G., ex-Governor of Barbados, has furnished this Office with some interesting notes in connexion with his personal experience in this matter. He points out that frequently, seed of temperate climate vegetables imported into Barbados, especially from America, fails to germinate satisfactorily even if planted shortly after its arrival. This has been our correspondent's experience during the present season, failure having been experienced in connexion with the seed of beetroot, turnips, carrots and kohlrabi. This has not arisen from the depredation of ants, which is so often responsible for bad germination, but simply from want of viability.

Referring to the question of raising seed locally, Sir Gilbert Carter points out that it is quite possible to raise and keep seed successfully in the West Indies if proper means

*Vol. XIV, p. 12.

are adopted. The fact that the germination of imported seed is so often unsatisfactory, and the fact that vegetables from seed produced locally grown over several generations show no signs of deterioration, would seem to make it desirable that greater attention should be given to the local production of vegetable seeds. It is possible that in many islands the production of vegetable seed might form a minor industry amongst the peasantry. Considering the large amount of seed that is imported, there is no doubt that there exists a big enough demand to make it worth while for a number of peasants to establish a seed-raising industry.

The following is what Sir Gilbert Carter says in regard to raising lettuce seed: 'There are two "Cos" lettuces which I have found to do well in the tropics, namely London "Cos" and Paris "Cos". The former makes a good heart without tying, and the latter makes a loose heart with light green and delicate leaves. Of the "cabbage" lettuces, the best I know is "Continuity", which makes a very fine heart and does not run quickly to seed. I have raised seed from this variety in Barbados with complete success. I selected a few of the finest specimens when they had thoroughly formed hearts, and then cut the plants off close to the ground, leaving the stumps to shoot. These were manured and kept supplied with the proper amount of water, the soil being kept loose around them and the selected plants treated with proper respect in view of their important destiny. Four shoots were retained to mature on each root, and the seeds when formed, allowed to ripen completely. They were then carefully gathered, dried and placed in narrow-necked bottles dried in an oven, and a piece of absorbent cotton wool placed on the top of the seeds. The bottle was then corked and sealed, and deposited in a dark dry place there to remain until required. This proceeding was completed by the middle of June, and in the following December, specimens were sown in boxes where they germinated very satisfactorily.'

Sir Gilbert Carter states that it would have been impossible to get finer and more satisfactory plants than those which subsequently developed from this locally raised seed. It is well known that in growing lettuce in hot weather the plant has a tendency to run to seed, the main shoot usually coming up from the centre of the heart. The 'Continuity' variety resists this tendency better than any other variety, and possibly the practice of obtaining seed from a later development of the plant encourages this retardation.

In conclusion Sir Gilbert Carter points out that in his experience English and French seed are better than American, though there appears to be an exception in favour of the seed tape, which embodies a new idea and a good one.

COMMERCIAL VALUE OF TOBAGO TOBACCO.

The value of tobacco leaf produced in Tobago is dealt with in the *Proceedings of the Agricultural Society of Trinidad and Tobago* for January 1917, in the form of a report received from the Imperial Institute, to which place samples were sent for examination. It appears that the samples received, like previous ones, showed the defect of poor burning quality. This is stated to be due to the small amount of potash and the large quantity of chlorides and sulphates present. The ash in sample No. 1 contained potash (K_2O) 18.4 per cent.; sulphates, expressed as sulphuric acid, 3.6 per cent.; and chlorides expressed as chlorine, 15.6 per cent. This defect, it is stated, may be due either to the presence of chlorides and sulphates in the soil, or to

the use of these substances in the form of manures for the tobacco, and the source of these deleterious constituents should be investigated. The British tobacco manufacturers consulted, regarded the tobacco as suitable for the market, while the merchants, though unable to offer an opinion as to the value of the tobacco, thought sample No. 1 represented material which would be saleable. This apparent conflict of opinion is due to the fact that the manufacturers regarded the tobacco from the point of view of cigar manufacture, and it is undoubtedly unsuitable for making cigars for the British market, except possibly in admixture in small quantity with better tobacco. It is added, however, that there is always a market in the United Kingdom for what is known as 'nondescript' tobacco, and merchants would no doubt be able to dispose of Tobago tobacco as nondescript tobacco for cutting purposes. Such material, however, fetches only a few pence per lb., and it is improbable that the price realized would be profitable to producers in Tobago.

The above remarks appear to indicate that the present production of tobacco in Tobago for local consumption in Trinidad is the best course to pursue, particularly in view of high freight charges.

The value of the report, in its present form, is seriously lessened by the fact that the figures of analysis of sample 2 have been omitted entirely.

THE ESTIMATION OF AGE IN MULES.

The following, taken from the *Veterinary Record* (for January 27) will be of interest to West Indian planters:—

In the cavalry of the French army, it has been ascertained that there is often a notable difference between the age attributed to mules by the buyers, and that found by the veterinary surgeons of the divisions to which the mules are sent.

These differences seem in a great part due to the fact that, in the literature upon age, the same indications are applied to mules which are classic and universally accepted for estimating the age of horses. Usually too much importance is given to the examination of the tables of the teeth, without taking sufficiently into account the length of the teeth, their form at their exit from the alveolus, etc.—all secondary characters, capable of furnishing useful indications to the observer.

The appearance, the falling, and the substitution of the milk teeth take place at almost the same epoch in the mule as in the horse; but the mule is always a little later than the horse.

In the adult mule, the tables of the teeth are narrower transversely than in the horse; the equalisation of the teeth is later; they become rounded more quickly, and the roundness persists for a long time; they only become triangular at a very advanced age. The considerable hardness of the dental tissue in the mule causes the incisors to be very little worn. They become abnormally elongated as the animal grows old, and arrive at a length of from 30 to 40 millimetres. After the sixth or seventh year in the mule the table of the tooth changes little in aspect, and after seven years it no longer furnishes exact indications. Such characters as the length, the direction, the form and the freshness of the incisors should also be taken into account. From seven or eight years forward the exact determination of the age of the mule becomes very difficult; and to judge it well, other indications beyond those furnished by the tables of the teeth should be utilized.—(*La Clinica Veterinaria*.)

THE PRODUCTION OF FOOD.

GREAT BRITAIN'S FOOD SUPPLY.

A review of the report on the food supply of Great Britain, drawn up by a Committee of the Royal Society at the request of the President of the Board of Trade, appears in *Nature* for February 15, 1917. It is stated that the first section of the report deals with the period before the war, and it is observed by *Nature*, that it is remarkable that the allowance then of protein, fat, and carbohydrates should so closely have coincided with the standard dietary usually associated with the name of Voit. Per head per day, the figures are a little below the Voit regimen, and give a total of 3,090 calories; but per man (making due allowance for women and children whose needs are smaller,) it works out above the standard (4,000 calories), so that a margin of waste was provided for. Part 2 of the report dealt with the year 1916, and shows that here again the available food was more than sufficient, so that reduction is possible; but the increase in prices has accentuated inequalities of distribution, and reduction below the necessary amount causes a large diminution in the working capacity of the individual. Organization in distribution is therefore called for; it would be foolish economy to produce a harmful effect upon the working population who form the backbone of the nation in its present crisis.

The final section of the report treats of methods of economy. The milling of flour and the reduction of beer manufacture are dealt with, and also the question of the age at which cattle should be slaughtered. One of the recommendations is that cattle should be slaughtered at seventeen months old instead of two and a half years; such young beasts would be a little poorer in fat, but that is counterbalanced by the enormous saving in feeding stuffs; economies may also be effected by certain changes suggested in the amount and character of the fodder employed. Finally, an increase in the making of cheese as compared with butter is urged.

In the article in *Nature* referred to, attention is called to the omission in the report of any reference to the vitamine question. It is pointed out that pure protein, fat, and carbohydrate with the necessary salt and water in addition, will not maintain health, still less promote growth. Certain unknown food accessories in small quantities are necessary also. Some of these so-called vitamins are present in the outer portion of the grain, but others equally vital are only soluble in fat, and are particularly abundant in butter. As they are absent in the vegetable fats, and so much vegetable fat is used in the preparation of butter substitutes, it really is a matter of national importance that the inferior nutritional value of the cheaper brands of margarine should be widely known.

Storing Corn-Meal in St. Vincent.—The Agricultural Superintendent, St. Vincent, writes to say that the corn purchased on a profit-sharing basis, kiln-dried and stored at the Government Ginnery in that island has been put on sale in the form of corn-meal for human consumption at 3½c. per lb. for lots of not less than 100lb., and 4c. per lb. for smaller quantities. There are 1,250 bushels available which will prove a valuable addition to the food supply of St. Vincent until the new crop comes in. The local retail price of brown and white wheat flour is 6c. and 7c. per lb., respectively, with every likelihood of greater advance in the future.

SUBSTITUTE FOR WHEAT FLOUR IN DOMINICA.

A general enquiry is now taking place throughout the West Indies in connexion with the possibility of substituting locally produced farinaceous material for some of the wheat flour at present imported.

THE VALUE OF FARINE OR CASSAVA MEAL.

In the *Dominica Official Gazette* for March 19, there is published a report by Mr. G. A. Jones, Assistant Curator and Chemist of the Agricultural Department, on the results of experiments concerning the use of farine meal. It is pointed out first, that compared with Antigua and St. Kitts, Dominica enjoys the advantage of being to a considerable degree self-supporting as regards the main food requirements of the population, owing chiefly to the presence of a large body of peasant proprietors. It is stated that for every 100 lb. of flour, rice, corn-meal and beans imported into Dominica per head of the population, Antigua imported 180 lb. and St. Kitts 162 lb. The only commodity which is imported into Dominica to any considerable extent is wheat flour, of which some 3,000,000 lb. are consumed annually. Concerning substitutes for some of this flour, Mr. Jones states that the product which offers most promise of success is farine; it is produced locally in considerable quantity, and is used and appreciated by a large section of the population. When ground and sifted, it forms a meal of good colour. But its composition like that of most root crops is poor in proteid—the flesh formers, and rich in carbohydrates—the heat and work producers. However, samples of bread prepared from wheat flour and farine meal in various proportions from 3 of flour to 1 of meal to equal proportions of wheat and meal were found to be quite satisfactory. Bread made from equal proportions developed in twenty-four hours a pronounced flavour of the farine meal, which however was not in any way disagreeable. It would appear therefore, that quite eatable bread can be produced by the admixture of farine meal with wheat flour, and that should it become necessary, the importation of the latter could be considerably curtailed by diluting it with farine meal. The only trouble appears to be that the bread shows a decrease in percentage of protein as the proportion of farine meal is increased.

In forwarding the above report by Mr. G. A. Jones to this Office, Mr. Joseph Jones, Curator and Agricultural Superintendent, makes the following comments:—

‘These experiments are interesting and desirable both in this and in other islands, but when these matters are looked into closely, there appears little probability of the people responding to the extent wished for, except under compulsion.

‘In Dominica the dilution of bread to the extent of one-third farine would require us to raise above our present annual requirements of cassava meal over 1,000 tons of tubers, and manioc requires nine to ten months from planting to mature.

‘Similarly in St. Lucia, assuming an annual import of about 5,000,000 lb. of wheat flour, dilution to the extent of one-fourth with potato meal, would require close on 1,500 tons of sweet potatoes (allowing for loss on drying) over and above the present production. It is doubtful if these local foodstuffs could be raised except by a gradual process extending over several years. A good deal of labour would be required for this work, which might affect other industries.

‘It is to be heartily hoped that nothing will happen to interfere with the importation of flour from North America.’

THE FOOD SUPPLY OF THE PHILIPPINES.

The Philippine Islands, like those of the British West Indies, annually import large quantities of foodstuffs. The chief among these is rice, and also cacao, coffee, dry legumes, potatoes, onions, starch, canned fruits and vegetables, and even fresh vegetables and fruits that could readily be grown in the islands. Commenting on this fact the *Philippine Agricultural Review* (Vol. IX, No. 3) says that this situation cannot be viewed as anything but deplorable. An idea of the extent of the importations is obtained by reference to the value of the various articles imported during 1905 and 1915, respectively. The value of the rice imported in 1915 was \$6,224,275. Very considerable quantities of fruits and vegetables, particularly fresh vegetables, continue to be imported; thus the value of the fresh vegetables imported in 1915 was \$344,545, compared with nil in 1905. In 1915 the value of the refined sugar imported was \$192,482, and molasses \$37,349. It is satisfactory to note that all the corn consumed in the island—and this amounts to a very large quantity—is produced locally. It would be interesting to know what arrangements are made in the Philippines for storing and distributing the large quantity produced. Flour and other articles that cannot be produced in the Philippines are imported in amounts that are relatively insignificant compared with rice, beans, cacao, coffee, fruit, tea, and vegetables.

The number of the *Philippine Agricultural Review* from which the above information is taken, contains an interesting and useful synopsis of the different food-plants that are grown in the Philippines in various localities, and at various altitudes. This list contains references to a good many fruit trees to which attention has been given in the Philippines during the last two years. Reference is also made to the cultivation of temperate vegetables such as cauliflower, celery and turnip. It is interesting to note that the latter plant exhibits special development according to the altitude at which it is grown. An elevation of 600 metres at least is required for the production of fairly good roots. Above this elevation the quality of the roots is increased in proportion to the rise in altitude up to 1,200 metres, where the growth of the turnip is very satisfactory.

A BRITISH CATTLE RESERVE IN AFRICA.

A letter appears in *United Empire* for January 1917, calling attention to the immense cattle reserves existing in Nigeria. It is stated that these reserves have been travelled over and inspected by a rancher of great experience, and he has reported that the lands contain not less than 5,000,000 head of cattle, that is to say more than exist to-day in the whole of Australia. The trouble has been to secure adequate reserves of land to allow for collecting and fattening prior to railings to Lagos. This is the first step necessary for capital to be put up to secure the erection of refrigerators. The only other difficulty for developing this new source of meat supply is the present one of securing shipping for conveying frozen carcasses from Lagos to England. There is little doubt, as soon as shipping arrangements have become more normal, that in Nigeria will be a British source of meat supply and one situated very much nearer to Great Britain than Australia and New Zealand, or even South Africa; and nearer too than the Argentine which at present is the great beef exporting country of the world.

RICE FLOUR IN DEMERARA.

The *Demerara Daily Argosy* of March 17, contains a report of a recent meeting of the Flour Substitute Committee.

Mr. Bancroft intimated the receipt of a mill from Messrs. Sproston, Ltd., and the purchase of one from Messrs. Brooker Bros. McConnel & Co. Ltd. In that connexion Professor Harrison submitted several samples made from the machinery referred to. He pointed out that they had encountered some difficulty in getting the rice reduced to flour with the machines at their disposal. He called the sample flaked rice, and of that some portion had been sifted. It appeared to him that in order to produce rice flour to the extent to give commercial returns they would have to get special flour-preparing machinery. With reference to the making of bread, the Professor continued, it seemed to him that the most beneficial returns were obtained not by mixing the flours in the first instance, but by preparing separate dough of the respective mixtures and then working them up together.

Mr. Bancroft said with the machinery they had acquired they could handle about 100 lb. of stuff per day.

Dr. Wise remarked that bread was being made on a large scale at the Public Lunatic Asylum with a mixture of rice, cassava and wheaten flour.

Mr. Bancroft exhibited several loaves of bread from the Penal Settlement made of wheaten and cassava and wheaten and rice flours. The loaves, he remarked, were about five days old. The speaker also mentioned the receipt of a number of very good loaves from Mr. Mansell's bakery. These were received shortly after the last Committee meeting.

Adulterated Bread—An unscrupulous baker will work into his bread as much salt as possible. Experts say that an increasingly large amount of salt may be put into bread without the consumer's being aware of it. The idea is that bread loaded with salt weighs more heavily on account of the moisture which it will retain. To find out the real value of bread from the stand-point of weight, a little experiment may be followed. Take two samples of equal weight, and bake these in an oven for an hour. At the end of this time weigh again. That which is the heavier is the better value. The addition of alum to bread to make it white (often used to mask an inferior flour) is much to be condemned. Small quantities of alum taken regularly in this way are very harmful. Happily a simple test for the discovery of alum in bread is available. Take a sample of the suspected article and place it in a saucer. Then pour over it a solution of carbonate of ammonia. If alum is present in the bread it will turn black, but if the bread is pure no change will take place (*Wealth of India*, December 1916.)

The acreage under tobacco in Rhodesia during 1915-16 was less than the previous year, but the acre-yield showed improvement, being 486 lb. as against 309 lb. per acre the year before, with the result that the crop reaped increased from 426,423 lb. to 637,261 lb., or an increase of 49.4 per cent. (*The Rhodesia Agricultural Journal* for December 1916.)

COTTON EXPORTS FROM THE WEST INDIES.

The following shows the quantity and value of Sea Island cotton exported from the West Indies during the quarter ended December 31, 1916:—

Colony.	Quantity, lb.	Value, £.
Barbados	21,414	1,606
St. Vincent	2,880	192
Antigua	nil	—
Montserrat	138,400†	13,414
St. Kitts	29,316	1,832*
Nevis	22,682	1,418
Virgin Islands	8,117	609
	222,809	£19,071

† 53 bales representing 20,034 lb. of lint of the 1914-15 crop are included in these figures.

* Value taken at 1s. 3d., but for the most part this cotton sold at 3s. in England, and the lowest value should be 2s. 6d. per lb.

INDIA'S SUPPLY OF COTTON.

On December 14, 1916, Professor J. A. Todd read a remarkably interesting paper on the world's cotton supply and India's share in it, before the Indian Section of the Royal Society of Arts. In summing up Professor Todd said:—

India is the only country in the world from which there is any hope of obtaining an early if not immediate increase of a million bales per annum of new cotton, and there is every reason to believe that India could maintain such an increase cumulatively till her present crop was at least doubled. As will be seen from Table D in the Appendix, the area under cotton is immense—over 25,000,000 acres in 1913-14, or two-thirds of the whole area, under cotton in America; though it may be noted in passing that, as will be seen from Table E, the increase of the Indian crop has hardly kept pace with that of the American over the last thirty years. Quite apart from any extension of this area, the crop could easily be increased by a gradual improvement of the yield per acre, which is the lowest in the world, only about 85 lb. per acre against nearly 200 lb. in America, and about 400 lb. in Egypt. That such an increase would pay handsomely at anything like present prices of cotton is beyond question, and it could be done without interfering at all seriously with India's essential supplies of other crops, especially food supplies. To effect such a change in the Indian crop is a very big problem full of practical difficulties, which however, are not utterly insurmountable. It will take a good deal of time and money to make the change, but it would take more money to get the same results in any other part of the world, and it probably could not be none at all in the time anywhere else. It is not, however, merely a question of growing an extra crop in certain parts of India, but of steadily and continuously improving the Indian crop a little all round, both in quantity and quality, by the adoption of better methods and the use of improved seed. That means constant and sustained effort on the part of every one concerned in agriculture in India, and a very much increased staff, backed by determined action on the part of the Indian Government in the direction of compelling reform of dishonest methods, and showing an example itself on a commercial scale of how things could be and ought to be done.

THE AGRICULTURAL DEPARTMENTS OF NIGERIA.

The following information, abstracted from the reports of the Directors of Agriculture, on the Agricultural Departments of Northern and Southern Nigeria, for the year 1915, should prove of interest to readers of the *Agricultural News*.

NORTHERN PROVINCES. In regard to the Northern Provinces, experiments started in 1913 at Maigana, with a view to producing a type of cotton of better quality and higher yield per acre than the existing indigenous plant, appear to have given satisfactory results. Different varieties were put under trial, and that known as Allen's long-staple (which had been acclimatized for three years in Uganda and was propagated for the first time in Nigeria in 1912) gave such satisfactory results, that in 1914 about 2 tons of the seed were distributed to local growers. The results were again distinctly good, the crop being purchased by the British Cotton Growing Association at 1½d. per lb. This proved so great an incentive to further effort that in 1915 the whole available supply of seed amounting to some 7 tons, was readily taken up. Moreover, the Association found the staple of such high quality as to warrant their paying 1¾d. per lb. for the 1915 crop. The opinion is expressed that if this price can be maintained, the future of cotton growing in the district is assured.

In an appendix comprising a report including work done at Maigana from March 1 1915, to February 29, 1916, when the last of the crops had been harvested, it is stated that the 'Allens' and 'Nyasaland' varieties of cotton maintained their average for yield, and their strength appeared to show a general improvement on last year.

SOUTHERN PROVINCES. Concerning the Southern Provinces, the report is naturally much more elaborate. It is stated that the cacao industry received most attention, the exports of this commodity increasing from 99,000 cwt. valued at £172,000 in 1914 to 182,000 cwt. valued at £314,000 in 1915. In addition it is estimated that there were in Lagos at the end of the year 40,000 cwt. awaiting shipment. Ibadan, which is the largest producing centre, has increased the output during the last five years from below 20,000 to over 50,000 cwt.

A cacao planting competition was organized in the Calabar Division to encourage farmers to lay out their farms in a proper manner. Prizes of £10, £7, and £3 were to have been given in December 1916, to the competitors who established the four best farms of 250 cacao plants with shade trees, in the manner advised in the Department's leaflet on cacao cultivation. Advice regarding suitable sites and other equitable assistance have been afforded by agricultural officers.

Sites for new model plots and nurseries were selected at Ikot-Ekpene, Warri, Benin, Sapele, Kwale and Abeokuta. Satisfactory progress was made in establishing the plot and nursery at all these places, with the exception of Warri, where sufficient labour could not be found to clear the site. The model plot at Ijebu Ode was acquired for building purposes, but a new site was selected, cleared, and shade trees were established ready for the planting of cacao and kola in 1916. At Oyo, plots of native and American (Georgia) cotton were planted to demonstrate the superior quality of the latter type. Arrangements were made for Oyo farmers to plant about 300 acres of Georgia cotton in 1916. More than 8,000 cacao, Para rubber, and coco-nut plants were distributed from the nurseries. This, it is pointed out, does not represent the total distribution for several of the caretakers are illiterate and were unable to keep records.

Courses of instruction in elementary theoretical and practical agriculture were given to school teachers at the Onitsha and Calabar agricultural stations during the two long school vacations. An examination was held at the end of the courses. Of twenty-three teachers who sat at Onitsha, eight qualified for a certificate; at Calabar, thirteen of the twenty-one candidates were successful. In awarding certificates, the results in both the theoretical and practical examinations were taken into consideration, so that good practical results were accepted as compensation for slight failure in theoretical knowledge.

Six youths were selected as agricultural pupils to be trained for the posts of Head Overseer and Agricultural Instructor. They are to spend the first three years of their pupilage at the Experiment Station, Ibadan. In addition to practical instruction, they are to be given, yearly, four courses of lectures in elementary agriculture.

During the period under review the membership of the Ibadan Agricultural Society increased from sixty to seventy-eight.

The results of a further test with the Hamel-Smith cacao drying machine at the Agege agricultural station (Model Farm) are recorded. Samples of machine-dried and sun-dried cacao were sent to the Imperial Institute for examination, where the composition of the beans was found to be quite satisfactory. Brokers, and cacao and chocolate manufacturers to whom samples were submitted for valuation, valued the sun-dried cacao at from 77s. to 79s. per cwt., and the machine-dried at 76s. to 78s. per cwt., at a time when St. Thomé and Cameroons cacao was selling at 74s. to 77s. 6d. per cwt. (July 1915). There is thus little to choose, it is observed, between the value of sun-dried and artificially dried cacao, provided the cacao is properly fermented and dried in both cases.

Annatto in Porto Rico.—Until the European war curtailed available sources of dye-stuffs, the market for Porto Rican annatto was very limited. In the fiscal year 1913-14, there were exported 211,886lb., valued at £2,753. The influence of war conditions began to be apparent late in 1914, when exportations rose to 337,299lb., valued at £5,564. Since then the increase has been considerable in both quantity and price. Before the abnormal conditions annatto sold as low as 16s. 8d. to 20s. 10d. per 100lb. At present it commands 54s. 2d. to 62s. 6d., according to quality.

According to a report by the United States special agent in Porto Rico, the supply of the product is extensive as the tree grows wild. The collection of the seeds, which constitute the 'annatto' of commerce, affords employment and a source of income to country folk, to whom any opportunity for earning money is a considerable boon.

The seeds of the bush or tree *Bixa orellana* are known commercially as annatto. The seeds yield a yellow colouring matter which has been employed in dyeing silk, cotton, and wool. The colour is somewhat fugitive. There is a widespread use in colouring confectionery, butter, cheese, sauces, varnishes, lacquers, and the like. The local name is 'achiote'.

If the present profitable prices continue, it is probable that the shrub will be planted on a large scale. *Bixa orellana* bushes a year and a half old yield, it is stated, from $\frac{1}{2}$ lb. to 1 lb. of annatto. This amount increases as the plant becomes older. (*Journal of the Royal Society of Arts.*)

Phosphate Determinations of Hawaiian Soils.—Bulletin No. 41 of the Hawaii Agricultural Experiment Station deals with phosphate fertilizers for Hawaiian soils and their availability. In regard to the solubility of different phosphates, some interesting results were obtained. For instance, hydrochloric acid of official strength does not dissolve all of the phosphoric acid of Hawaiian soils. To determine the total phosphate content, it is necessary to fuse the soil with sodium carbonate. Fifth-normal nitric acid has very little solvent action upon the phosphates in the soils, indicating the absence of appreciable quantities of calcium phosphate. One per cent. citric acid has a much stronger solvent action than fifth-normal nitric acid. Of the weaker solvents, 1 per cent. sodium hydroxide is the strongest, due to its action on the iron and aluminium phosphates. It is concluded that the fertilizer (phosphate) requirement of the soil is not measured by solubility in water or fifth-normal nitric acid, but it may be indicated by the solubility in citric acid. It is further concluded that the solubility of the phosphate before it is added to the soil cannot be used as a criterion of its solubility after addition, but it may indicate its availability. The fixation of a soluble phosphate by the soil may be influenced by the basicity of the soil. Availability as determined with solvents does not agree in full with that indicated by plant growth. Apparently Hawaiian soils are uniformly higher in phosphate than mainland soils, but this is less available, especially in the heavy clay types. Phosphoric acid should be applied to this type of soil in the form of soluble phosphates and in light applications at frequent intervals, if rapid returns are anticipated.

The United States and Tropical Produce.—The increasing dependence of the United States on the tropics for raw materials and foodstuffs not produced in that country is shown by the fact that more than a billion dollars' worth of tropical products were brought into that country during the fiscal year 1916. The exact total, \$1,060,850,416, represented an increase of \$253,208,231 over the year 1915. Imports of rubber amounted to \$304,000,000 during the fiscal year 1916, against \$280,000,000 in 1915, and \$109,000,000 in 1905, and were exceeded in value only by sugar, coffee and fibres. (*India Rubber World*, February 1917.)

According to the *Journal of the Jamaica Agricultural Society* for December 1916, the scarcity of foodstuffs in that island is creating some alarm, and the planting of provision crops is being everywhere advocated. But it is stated that the scarcity of foodstuffs is due rather to last year's hurricane than to the war. Bananas, yams and cassava all suffered largely from the storm.

It is a common mistake in growing vegetables not to make the soil fine enough, and the seeds are sown among small clods. At other times the soil is in too soft a condition, and the seeds are planted in loose soil. Such soil conditions are often responsible for unsatisfactory germination or at least weak development. Very often vegetable seed is planted too deep. The smaller the seed the shallower it must be planted; peas may be planted 2 inches deep, lettuce seeds merely raked in and barely covered. Seeds should never be sown too thickly.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number indicates the large amount of assistance that has been rendered to the West Indian peasantry by the Departments of Agriculture in recent years.

On pages 100 and 101 will be found a series of articles dealing with food-supply questions.

An interesting article dealing with a new system of mulching will be found on pages 110 and 111.

Insect Notes in this issue deal with the locust invasion of Egypt in 1914-15.

Forthcoming Issue of the 'West Indian Bulletin'.

The *West Indian Bulletin*, Vol. XVI, No. 2, is shortly to be issued. This number will contain original papers and reviews relating to tropical agriculture and science, and is likely to prove of more than usual interest. The following is a list of the contents:—

Note on the Recovery of Sugar at Gunthorpes Factory, Antigua, 1905-16, by Sir Francis Watts, K.C.M.G., D.Sc.; The Identity of Fibre-Agaves, by Professor L. H. Dewey (with a key to *Sisalanae* in the West Indies, by William Trelease); On the Inheritance of the Number of Teeth in Bracts of *Gossypium*, by S. C. Harland, B.Sc.; Note on the Significance of the Results obtained in the Dominica Manural Experiments with Cacao, by W. R. Dunlop; The Characters of certain Soils in the Area Devastated by the Eruptions of the Soufrière of St. Vincent in 1902-3, by H. A. Tempny, D.Sc.; A Note on the Gall Patches in the Soils of Antigua, by H. A. Tempny, D.Sc.; Note on Lime Requirements of Soils for Partial Sterilization, by H. A. Tempny, D.Sc.; The Fungi of the Internal Boll Disease, by W. Nowell, D.I.C.; Poisonous Fishes in the West Indies, by W. R. Dunlop.

The cost of each number of the *West Indian Bulletin* is 6d.; post free 8d.

Crop Estimates in Certain Countries.

In *The Board of Trade Journal* for January 4, 1917, is published information, received by the Board of Agriculture and Fisheries from the International Institute of Agriculture at Rome, concerning crop estimates in certain countries, which is of interest in the West Indies. The production of wheat for the current season is estimated at 79,682,000 cwt. in Australia, 41,461,000 cwt. in Argentina, 114,977,000 cwt. in France, and 342,805,000 cwt. in the United States (winter and spring together). The French barley crop is estimated at 16,888,000 cwt. Oats are expected to produce 9,603,000 cwt. in Argentina, 81,256,000 cwt. in France, and 357,716,000 cwt. in the United States. The production of maize in the United States is estimated at 1,291,623,000 cwt.

The total production of wheat in Canada, the United States, British India, European Russia, United Kingdom, France, Spain, Italy, Norway, Denmark, Netherlands, Roumania, Switzerland, Japan, Egypt, and Tunis is given at 1,327,623,000 cwt. The total production of barley in the same countries as for wheat, with the omission of India, is estimated at 439,485,000 cwt., and of oats, in the same countries as for barley, with the exception of Egypt, at 802,313,000 cwt.; while the production of maize in Canada, the United States, European Russia, Italy, Switzerland and Japan is given at 1,372,248 cwt. As compared with the corresponding average crop in the years 1909-13, these estimates represent increases of 1.1, and 3.2 per cent. for barley and oats, and decreases of 9.1 and 5.3 per cent. for wheat and maize, respectively.

The Value of Dynamite in Agriculture.

Trials that have been made with dynamite in the West Indies, to discover to what extent it is of value for opening up the soil in orchard cultivations, have not, on the whole, given very encouraging results. In Dominica the experiments on the soil containing lime trees have given entirely negative results, and the Trinidad experiments on cacao and bananas have been inconclusive.

It has been suggested that perhaps these explosions have been made at the time when the soil is in the wrong condition. An explosion made in a wet soil, for instance, is much more likely to have a consolidating effect than a loosening one; perhaps the Dominica experiments were made when the soil was too wet; if they were, this would account for the absence of any good effect as a result.

It would be interesting to compare the effect of explosions made: (a) during wet weather, (b) after a spell of dry weather when the soil is comparatively lacking in moisture.

In Dominica it is not easy to get a dry soil, but at the present time of year a condition of dryness sufficiently pronounced will occur from time to time to allow of the experiment being made.

Imperial and National Organization.

A very original series of articles on the elements of national reconstruction, since published in book form, appeared about the middle of last year in *The Times*. In these articles it was submitted that the syndication of small businesses is necessary to effect economic efficiency, and that in conjunction with this there will follow better scientific education and research. The present form of district representation in Parliament is disapproved of, and it is believed that a proper management of the country's affairs can only take place under conditions of occupational representation; that is to say, industries and professions should be represented rather than the mixed community of any one district with its divided and often conflicting interests. In connexion with these articles, the reports of the British Empire Producers' Organization, whose fifth monthly report has recently been forwarded to this Office from Kingway House, London, are of considerable interest, showing that a definite policy is on foot in the direction of organizing British Industries on an empire basis. The B. E. P. O. is not a society in the ordinary sense of the word, since it does not enrol members or firms except as representing associations or industries. It is in fact, a federation of industrial associations. It recognizes that existing associations which affiliate must retain complete autonomy, and that those representing an industry are the right bodies to formulate a practical policy for that industry. The organization is divided into sections of which the sugar section is of direct West Indian interest. It is important that producers of raw material in the West Indies should keep in touch with the Association, as it is a highly influential body and calculated to prove of great value in maintaining the trade, and in developing the resources of the Crown Colonies.

Primary and Secondary Education in British Guiana.

A striking memorandum on the subject of primary and secondary education has been submitted to the Board of Education of British Guiana by the Acting Governor, and published in the *Demerara Daily Argosy* (Mail Edition) for March 17. In this the need for revision in the education codes of primary and secondary schools is drawn attention to, and the importance of instruction in nature knowledge is emphasized. Considering first the curriculum of a primary school, it is pointed out that the chief subjects taught are reading, writing and arithmetic; but a course of study concentrated mainly on these three subjects concerns itself, in the opinion of the Acting Governor, rather with the implements of the mind than the subject-matter of education. Another weakness in the curriculum is the large amount of attention given to religious instruction, in the course of which the pupil is taught a good deal of Jewish history and Syrian geography, together with a few of the broadest and simplest principles of morality. It is submitted that the methods of moral instruction need revision, and that more attention should be given to an appreciation of nature from an aesthetic as well as from a scientific stand-point, and to a practical study of geography beginning first with the district in which the school is situated. On the subject of nature knowledge, the views expressed in the memorandum appear to be particularly sound. It is held that in a colony like British Guiana, which is in the main agricultural, the education given to the bulk of the population should aim at training a class of intelligent peasant proprietors and farmers, and for this purpose there can be no better method than to lay the mind of the pupil alongside of physical facts, and teach the child to conquer them in the way in which Nelson told his captains to master their enemy's ships. In regard to the question of classics *versus* science, which has particular reference to secondary education, the views of the writer of the memorandum are as follows: While a knowledge of Greek and Roman history and thought is admitted to be important, it is held that this can nowadays be obtained by means of translations, thus obviating the slow process of acquiring a knowledge of the dead languages. It is held that, as in the case of primary schools, the subjects embraced under the head of nature knowledge should in the secondary form the basis of education. 'A thorough study of the English language can be made to fulfil all the philological and scientific purposes of a study of Latin; and if a second language is desired, French is of as great an educational and of far more practical value to-day than Greek.'

While the opinions put forward in this memorandum may not seem altogether acceptable in certain quarters, no one can deny the soundness of the views, nor question the belief that the developments of the Colony would be accelerated by the introduction of a curriculum more definitely based upon the principles submitted.



INSECT NOTES.

THE LOCUST INVASION OF EGYPT, IN 1914-15.

The report of the Ministry of Agriculture in Egypt on the great invasion of locusts into that country in 1914-15, has recently been received, and this opportunity will be taken to give a brief review of the chief points of interest in connexion with this invasion, and of the measures taken to deal with it.

The species in question is the migratory locust (*Schistocerca gregaria*), which has always been associated with Egypt by reason of the fact that the earliest records of this insect are from this country, and because locusts have always had an important influence on the agriculture of Egypt, since the presence or absence of these insects usually meant the failure or success of the crops. The figures of locusts represented on Egyptian tombs dating back to 1400 B.C. and reproduced in modern works are so accurate that there can be no doubt that the species concerned was *Schistocerca gregaria*, and it is thought that this same species is the one referred to in the Biblical record of the Egyptian plague of locusts, which took place about 1490 B.C. Their attacks are by no means confined to the Nile Valley, but are felt throughout South-western Asia and North Africa. This species breeds normally in Palestine, Arabia, and the Sahara oases, and invades Egypt under favourable weather conditions, an invasion usually extending over the greater part of a year, and breaking in successive waves over different parts of the country. In this connexion it has been noticed that these waves often come when the weather of Egypt is under the influence of a depression.

The experience of the last thirty years or so tend to show that these visitations occur about every ten years, but it seems very probable that the invasions were much more frequent in earlier times. In previous invasions no complete investigations of this insect had been made, and opportunities of making an extended study of the life-history and habits, and of working out effective control measures had been lost. The formation of a Government Agricultural Service since the 1904 invasion resulted in 'a careful investigation into the habits and influences controlling the direction of flight of the migrating forms from their first appearance.' At the same time a record of the life-history and parasites of the succeeding generations was obtained.

It was realized that the peculiar local conditions existing in Egypt might necessitate special methods of control. Accordingly, during the course of the invasion all the methods of destruction employed in other countries were tested, but were finally rejected after thorough and practical experiments.

HABITS AND LIFE-HISTORY.

Before giving an account of the methods of control it is proposed to mention as briefly as possible some of the more

characteristic habits of this species, and to outline its life-history. The locusts which reached Egypt in 1915, although winged adults, were not sexually mature, and the swarm was composed almost entirely of reddish-coloured individuals. At this stage they usually spend the day on the move among the cultivated lands, while during the night they settle on any available support, such as trees and shrubs, or failing these, camp on the ground. It was noticed that the swarms of locusts when in flight assume different positions according to the strength of the wind. 'In a gentle breeze they fly directly up the wind; if the wind strengthens they immediately respond by changing their direction to a diagonal to the wind. In a moderately strong wind they will be observed flying at right angles to the wind direction, and as the wind velocity increases their line of flight is turned more and more until we find them flying down the wind when a gale is blowing.' As sexual maturity approaches, the locusts gradually change colour, the males becoming a brilliant yellow with their original black markings, and the females also changing to a less extent.

Egg-laying begins soon after mating, the female drilling a hole in the ground with her ovipositor. The eggs are laid in masses ranging from 80 to 120 at the bottom of the cylindrical hole bored by the female, and the space left at the top is filled with a frothy substance. This soon hardens sufficiently to serve as a protection for the eggs, but still permits the emergence of the newly hatched nymphs. The females seem to be very particular in their selection of a good place for depositing their eggs, and it is stated that a favourite place is always where an inch or two of dry sand covers a moist sand, clay, or silt. Banks of canals, railway embankments, and drains or irrigation channels in the fields are often chosen, and in such situations the eggs usually occupy a definite zone affording sufficient moisture. 'In cultivated fields the higher parts and infertile patches known as *boor* land are very frequently chosen. In some parts of the country eggs were never found among crops, elsewhere the locusts had selected such places freely. This appeared to depend on whether the land was under perennial irrigation or was basin land, crops in basin land usually being avoided; generally the females avoided soil penetrated by roots of the plants.' It was also noticed that along the banks of the Nile the eggs were often laid at one particular level above the water, forming a strip of perhaps a metre wide by one or more kilometres long. Above and below these strips no eggs were laid. 'Newly laid eggs are golden brown in colour, but they soon change to a dull grey or brown colour, with a faint pinkish tinge.'

The eggs hatch in from sixteen to thirty-six days according to temperature and moisture conditions, and the newly hatched nymphs are green, but soon turn black. They do not feed at all during the first four to eight days, even where food is plentiful, but are voracious feeders when once they start. From an early age they tend to climb and cluster as high as possible, keeping together in masses, and this habit of massing together has an important bearing on the methods adopted to control them, as will be seen later. This species usually moults five times before becoming adult, but six moults have been recorded. The whole stage from hatching to adult usually occupies a little over seven weeks. When about to moult the hoppers after the first stage usually cluster together on bushes, or any raised object available. 'The old skin splits along the middle of the thorax and the insect emerges, leaving the empty skin otherwise intact. Empty skins were often found together, in every way looking like a crowd of young locusts.'

CONTROL MEASURES.

In every country where locusts abound the methods of destruction have to be adapted to local conditions. It may be mentioned that in Egypt vegetation is practically non-existent except where the land is artificially irrigated, and there is no irrigated land which is not closely cultivated. Consequently, the only food available for locusts consists in cultivated crops, so that in view of the value of the crops it is essential to destroy the locusts before they can begin feeding. This necessity for killing the locusts before they can attack the crops rendered impracticable the use of stomach poisons, such as arsenate of soda or Paris green, or the inoculation of disease cultures of *Coccobacillus acridiorum*, as these cannot act unless consumed along with the food. There remained, therefore, such methods of control as collecting of adults and egg-masses, destruction of nymphs by driving them into prepared trenches and burying them, or spraying with contact insecticides.

Before the arrival of the expected invasion circulars were distributed to the headmen of the various villages throughout the Nile Delta and lower valley. These contained full instructions as to dealing with the invading swarms of adults, the egg-masses which would be subsequently laid, and the young nymphs. Accompanying these recommendations were illustrations of a locust laying eggs, of the eggs themselves, and of young nymphs.

Accordingly, the first swarm, as soon as it arrived, was vigorously attacked, and the campaign was carried on throughout the first half of the year 1915, during which time the invasion was at its worst.

The work of destroying the adults and eggs was paid for at rates previously fixed by the Government, while digging of trenches for burying the nymphs was carried out under the existing system of organized unpaid labour (*corvée*) in each village. The invading swarms were collected in large numbers in the early mornings when they are paralyzed, and then killed either by burning or by burying in pits, the latter method being the most satisfactory.

The systematic destruction of eggs was carried out everywhere, either by hoeing over the egg-deposits and exposing them to the heat of the sun, or by ploughing up the land two or three times. In some places the egg-masses were also collected and burnt, while in other localities the land was flooded in order to smother the eggs; this latter method seems to have been more successful in heavy land than in light sandy soil. However, in spite of the extensive campaign against the adults and eggs, such an immense number of nymphs still hatched that their subsequent destruction constituted the major part of the problem of control.

As stated above, it was soon found that poisoned baits could not be used, since the nymphs did not feed for some days after hatching, but often spent this period in travelling from the laying ground in the desert into cultivated areas. It was therefore necessary to kill them before they could reach the crops. All the able-bodied population of the threatened district were turned out, some to dig trenches, and others to drive the young locusts into the prepared trenches. These trenches had to be dug between the desert places where the eggs were laid and the cultivated fields towards which the locusts would be marching. When the locusts had all been driven into a trench the earth was thrown back into it and well trodden down. Advantage was taken of the fact that the young nymphs collect on any raised object to burn them *en masse*, or to spray them with a contact insecticide.

Many other methods were tried with varying success, but the above mentioned were the most successful. Some idea of the work that was done may be gathered from the statement that over thirteen thousand metric tons of locusts were collected, representing over seven billion individuals, while some twenty-seven billion eggs were destroyed. It was also estimated that at least many young hoppers were killed.

The result of this campaign was that no locust swarms reached maturity in Egypt and the damage done was generally small, a very large percentage of the cotton crop of the Delta being saved. The docility of the natives and the system of unpaid labour enabled the campaign to be organized and carried out successfully, and Government supervision is absolutely necessary, since the native population, if left to themselves, would be unable to deal with a locust invasion.

It may be mentioned here, that the South American migratory locust (*Schistocerca paranensis*) was abundant in Venezuela in 1915, doing serious damage to vegetation there, and threatening to invade Trinidad. The breeding grounds of this locust in a country like Venezuela, where there is a dense tropical growth, are fortunately few and far between, so that there were none of the enormous hordes which occur in Africa or in the Argentine.

EFFECT OF MANURES ON THE COMPOSITION AND QUALITY OF ORANGES.

The *Journal of Agricultural Research* (Vol. VIII, No. 4) contains an interesting paper on the above subject, dealing with results obtained in California. By way of introduction, the author, H. D. Young, says:—

Of the great amount of work which has been done with fertilizers, only a relatively small proportion deals with their effects on the quality of the crop. This is especially true of fruits, partly because of the length of time required, and partly because of the conflicting factors which enter into a long-time experiment.

The material presented in this paper has to do with oranges (*Citrus aurantium*). The quality of this crop may offer an easier subject for study than most fruits, as the factors affecting it, such as the percentages of sugar and acid, the texture of the fruit as a whole (its specific gravity), and the proportions of juice and rind, can be accurately measured.

The following is a summary of the main results arrived at:—

Nitrogen is the only fertilizer which in this experiment seemed to exercise a specific effect on the composition of oranges.

Applications of nitrogen to the soil resulted in a slightly lower amount of sugar, a somewhat coarser fruit, and a little less juice in the orange.

The effect of nitrogen was the same, whether applied alone, in combination with either potash or phosphoric acid, or both.

The effect of nitrogen was greater in 1915 than in 1914. As the crop was picked about two months later in 1915, it would indicate that some effect other than delayed maturity was caused by the nitrogen.

Comparison with fruit from similar trees grown outside the fertilizer plots shows a fair agreement of composition and quality.

The analyses show a higher percentage of nitrogen from all plots receiving it, while no such effect was obtained with either phosphoric acid or potash.



GLEANINGS.

In the *Agricultural News* for March 10 was published an article on rice as human food. Further details concerning the composition of Indian rices will be found in the recently issued Bulletin (No. 62) of the Agricultural Research Institute, Pusa.

During 1915-16 the large total of 293,785 seedlings was distributed for planting from the Antigua Experiment Station. These included 3,756 coco-nuts, 2,257 Eucalyptus, 30,500 onion plants, and 254,617 cane plants. Besides these, a considerable quantity of cuttings and vegetable seeds were sent out. The foregoing constitutes a record distribution.

An inquiry has recently been received in regard to the suitability of Burbanks spineless cactus for planting on waste lands in the drier parts of the West Indies. Trials made over several years by the Danish authorities in St. Croix have shown that this cactus does not appear to be suited to West Indian conditions; its growth is slow, and even after a number of years, the amount of fodder produced is unsatisfactory.

It is stated in *Science* for December 15, 1915, that Professor A. S. Hitchcock, Systematic Agrostologist, United States Department of Agriculture, has returned from a five months' exploration tour of the Hawaiian Islands, and has brought back an important collection of plants. It will be remembered that Professor Hitchcock has rendered assistance in the British West Indies in regard to the identification of grasses.

The *Revue Agricole* of the Island of Réunion, reproduces the article on the Hitchin Bacon Factory, which was published in the *Journal of the Board of Agriculture* of England and Wales, and in the *West Indian Bulletin*, Vol. XV, No. 3. It appears that in Réunion, as in the West Indies, there are considerable possibilities in regard to pig raising and the production of bacon and ham. It will be interesting to learn of any action in this matter which may be taken by the French authorities at Réunion.

In contra-distinction to school gardens, home gardens are becoming increasingly popular in Canada. The *Agricultural Gazette of Canada* contains an account of the progress made in various provinces, and it appears that the scheme is successful and useful. A good deal depends on the assistance and supervision of the visiting teachers. It appears that the pupils take a greater interest in home gardens than in school gardens, which is only to be expected in view of the fact that the home garden is entirely in the pupil's own hands.

The Government Meteorologist, Jamaica, has prepared a paper, which was published last year, on cloud drift as observed at Kingston during 1907-13. The report deals with cloud movements at different levels, and furnishes information as to the movements in the upper atmosphere. Three classes of clouds are dealt with, low cloud at 1,000 feet, middle 4,000, and upper 10,000 to 12,000 feet. Account is taken of the frequency of cases of observed direction of the drift at 7 a.m. and 3 p.m. daily.

An account of the returns of crops grown by Europeans in Southern Rhodesia during 1915-16, appears in the *Rhodesia Agricultural Journal* of last December. While the returns are gratifying as a whole, it is stated that naturally they reflect the unfavourable season that was experienced. The area under ground nuts was nearly doubled, and the output more than doubled. The proportion of land under maize was 86 per cent. of the whole area cultivated; in the previous season it was as much as 91 per cent. There was an increase under wheat. There are nearly 2,000 acres in citrus orchards in Rhodesia.

In an address recently delivered before a large gathering of farmers in Bedfordshire, the Rt. Hon. R. E. Prothero, M.P., President of the Board of Agriculture, made certain observations which are not without their application to the West Indies. He pointed out that farmers do not make the prices that they get for their produce, those prices are made for them; and at the present time they are made particularly in the case of wheat, by the shortage throughout the world, by high freights, by cost of all the materials of production, and by the great demand on the mercantile marine. The same remarks apply to the price of sugar.

The Committee appointed by the Agricultural and Commercial Society of St. Lucia to draw up a Prize-holdings scheme for limes and cacao, have forwarded to this Office a copy of the report that has been prepared. It is proposed that only persons owning not more than 20 acres of land will be allowed to compete. The prizes range from £3 to £1. The scale of judging appears to be sound, but it will be necessary for the examiners to be careful always to see that they pay due regard to the improvements that are effected, and not to desirable features of the holding already in existence. The above scheme is a continuation of one that was in operation several years ago.

A lengthy article appears in the *The Times* of January 25, on the rainfall of the British Isles during 1916, by Dr. H. R. Mill, Director of the British Rainfall Organization. This shows that 1916 was a wet year. In regard to the inevitable question as to whether the data justify attributing the wetness which has characterized the past three years, to the war, Dr. Mill answers emphatically in the negative. For amount of rain it is stated that 1912 was much more remarkable than 1916, while as to distribution of rain in the south-east of England, where, if anywhere, the effect of gun-fire on rainfall should be clearest, the same general type of distribution has prevailed since 1909, and the years 1910, 1912, 1915, and 1916 are remarkable for their similarity, and must, it is thought, owe that similarity to similar conditions in the flow of the great rain-bearing air currents over the Atlantic.

ATTEMPTS TO GROW ONIONS OUT OF SEASON IN ANTIGUA

Mr. T. Jackson, Agricultural Superintendent, Antigua, has forwarded the following note on experiments made to grow onions out of season in Antigua.

It has been clearly demonstrated during the past decade that the amount of profit accruing from a given area of land planted under onions, either for export or local consumption, depends to a considerable extent on the earliness of the crop. During a normal year the early part of the Antiguan crop is placed on the market before the Bermudian crop, or any produced in the Southern States of America. This fact gives the local planter a great advantage over his fellow planters in less favoured situations.

It is, however, only a proportion of the local produce that gets into the early markets and meets with little competition from onions grown in other centres; the other portion often meets with some rivalry. The question as to how this should be avoided has for some time occupied the minds of Officers of the Agricultural Department, and planters. At one time it was thought that the planting of sets would be one way out of the difficulty, but experiments inaugurated with the view of raising a crop from these were abortive; only thick-necked onions were produced; in fact, the mature produce resembled leeks rather than onions. Failure to grow onions from sets has also been recently recorded from Bermuda. It might be noted, however, that the successful raising of onions in the West Indies from sets has been reported. As far as can be ascertained, the sets used for all the trials mentioned were imported; attempts that were made locally to save sets from one season for planting the next were all failures. In consequence of the failure to raise onions for the early market by means of sets, it was thought that seeds might be kept from one season, from which early produce could be raised during the next. The result of a 'seed storage' trial was recorded in the Antigua Botanic Station Report for 1913-14. Without going into details, it may be said that the experiment indicated that onion seed could be kept in seed receptacles in Antigua for about six months, after which its power of germination rapidly decreased. For the purpose required, this period of time was too short by some two or three months.

In 1915 the Imperial Commissioner of Agriculture for the West Indies caused a small quantity of onion seed to be forwarded from Teneriffe to the Royal Botanic Gardens, Kew, to be stored under controlled conditions. This seed was stored from August to March. The following is a copy of a memorandum from Kew, dealing with the seed in question:—

'2 lb. of seed of the above (White Bermuda Onion) were received from the Canaries in August to be stored at Kew for the West Indies.

'They were divided into three portions: one (a) being placed in a glass bottle with cotton wool stopping; one (b) in a stout paper seed packet, and one (c) in an air-tight tin. When the seeds arrived a trial sowing was made, 100 per cent. germinated.

'In March sowings were made from the glass bottle and paper packet and every seed germinated.

'The packages have been kept in a dry cupboard in a room at a temperature of about 55° F.'

These seeds arrived in Antigua in May, and owing to certain unavoidable circumstances were not opened for about one month. On June 10 the seeds were sown in nursery beds, and samples retained for germination tests which were made at the Government Laboratory and Botanic Station. The germination percentage in both cases agreed fairly

closely, and the mean results are given below:—

A, germination	53	per cent.
B, "	46	" "
C, "	44	" "

The growth made in the nursery beds by the seedlings raised from 'A', 'B' and 'C' lots of seed was, on the whole, good, and there was little to choose between the plantlets raised between the two former lots; the seedlings from 'C' were perhaps not quite so strong and vigorous as the others. In addition, two other sets of seeds were kept in cold storage in Barbados. These may be designated 'D' and 'E'. The germination test for these was 30 and 37 per cent., respectively.

When in the seed beds however, one lot failed to germinate altogether, and the seedlings obtained from the other were weakly. It is not known what temperature these seeds were subjected to when in cold storage, but if it was anything near freezing point, it is possible that rapid thawing after removal ruptured the tissues. As far as this trial goes, one may say that onion seeds cannot with any degree of certainty be kept from one season to another in cold storage in the West Indies.

The seedlings obtained from the seed kept in England were transplanted into a $\frac{1}{10}$ -acre plot on July 19. This work was done under the supervision of one of the officers attached to the Experiment Station. When the plants were taken up from the nursery it was noticed that the size of the bulbs was out of proportion to that of the foliage. They had the appearance of having been left too long in the seed beds; this was not the case however, as reference to the dates given indicates. When in their permanent positions no apparent growth was made for some two or three weeks, and a large proportion of the young plants died in spite of attention as regards artificial watering, necessitating several supplyings. The reaping of the produce was commenced on January 25, and completed on February 12, the plot giving 170 lb. of onions, of which 45 lb. were unsound.

The bulbs obtained from this trial were, on the whole, of indifferent shape, consisting of a large proportion of what is known as 'thick necks'.

Caution is necessary in drawing conclusions from a single experiment, but it would seem that we have obtained some definite information in connexion with the growing of onions for early markets. There can be little doubt that onion seed can be kept in England for several months without fear of deterioration, but on reaching the tropics it evidently loses its vitality rapidly.

On the other hand, seed that will germinate but will not subsequently produce marketable bulbs is of little practical value. The appearance of the onions under discussion, when growing at Skerretts, resembled that of plants growing in an undesirable environment. This together with one's knowledge as to how vigorous the crop grows during certain months indicates that there is a question of 'season' to be considered. In the trial under discussion, the seeds arrived in Antigua in May and were sown a month afterwards. To solve the question as to the earliest possible date when the onion crop can be grown in Antigua, a small quantity of seed kept under controlled conditions in England might be sent so as to arrive during the months of May, June and July. If these were sown immediately on arrival, it is possible that the point would soon be cleared up. Such seed should be sent direct to the place where it is to be grown, so that its vitality may not be impaired by the tropical climate.

[Arrangements have been made with Kew to give effect to this proposal during the present year.—Ed. A. N.]

A NEW SYSTEM OF MULCHING.

Green-manuring problems formed the subject of an editorial in a recent issue of the *Agricultural News* (January 27), and in connexion with what was said concerning the fermentation of green dressings in the field, the following summary of Bulletin No. 499, United States Department of Agriculture, will prove extremely interesting. It is also suggestive in connexion with the usual West Indian method of mulching:—

Mottle-leaf of citrus trees is characterized by yellowish spots or blotches on the leaves, and by a reduction in the size of the leaves and the density of the foliage. In its advanced stages it results in a marked reduction in yield, and in the size and quality of the fruit. No fungus or bacterium has yet been found to be causally associated with this trouble.

Work carried out by the writers in 1914 and reported in another paper showed that half of the mottling in about 120 orange groves, in the Riverside, Redlands, Rialto, and Highland districts of California was associated with a low humus content of the soil. Evidence was also secured which indicated that inadequate irrigation might be responsible in part for the development of mottle-leaf.

The present paper is concerned with field experiments relating to the irrigation of oranges and the use of organic fertilizers, and deals particularly with a new method of citrus culture, the mulched-basin system, in which low dikes are thrown up so as to form large shallow irrigation basins near each tree, and each basin is heavily mulched with alfalfa hay, bean straw, manure, or some other organic material. The basin makes it possible to supply each tree with water in accordance with its needs, while the water carries with it to the feeding-root system the plant food extracted from the disintegrating mulch.

The system of furrow irrigation and clean cultivation in common use in citric districts in California tends to promote the formation of a plowsole, or incipient hardpan, below the surface mulch, varying in thickness from 3 inches to 2 feet; leads to excessive accumulations of soluble plant-food substances, especially nitrates, at the surface of the soil, where they remain until washed down by the winter rains; and fails to conserve the soil moisture sufficiently to prevent the trees from wilting frequently during the summer months.

The mulched-basin system was found to conserve the soil moisture better than any other system of soil treatment compared with it, and none of the basined trees on either light or heavy soils wilted. Under all the other cultural methods employed, wilting occurred at some period during the summer on both light and heavy soils.

Available soil moisture below the third foot did not prevent orange trees from wilting if the moisture content in the first 3 feet of soil fell below the wilting coefficient.

With the amount of irrigation water ordinarily available in these districts (1 miner's inch to 4 or 5 acres) cover crops of barley or sweet clover can not be grown during the summer months in groves on either heavy or light soil without causing the wilting of the orange trees.

Circular trenches dug around orange trees, filled with manure or alfalfa, and covered with dirt, did not remain open sufficiently after the second irrigation to distribute the irrigation water adequately.

In the clay-loam soils of the type constituting the Victoria area, the lateral movement of moisture is very slight. In such soils the furrow system of irrigation is adequate unless a large number of furrows are used, including furrows under the trees.

Moisture determinations in groves in which alfalfa was being grown as a permanent cover crop show that the irrigation water never penetrated deep enough into the soil to ensure an adequate moisture supply for the orange trees.

For a basin having an area of 150 square feet, the experiments indicate that approximately 150 lb. of alfalfa or 15 to 20 cubic feet of stable manure will be required each year to maintain an effective mulch.

It is not possible with the water ordinarily available to grow mulching material between the basins sufficient to maintain a satisfactory mulch on the basins. Cover crops, however, can be grown between the basins on winter rainfall to supply part of the mulch, and where water is available in the summer it can be used for the same purpose.

Orange trees on clay-loam soil, such as the Victoria soil, responded more quickly to the mulched-basin system than trees similarly treated on light soils, because the heavier soils under the furrow method of irrigation do not absorb moisture as rapidly as lighter soils. Mulched-basin trees on clay-loam soils showed a marked response to the treatment in three months, while basined trees on light soils required from six to twelve months to show a growth superior to that obtained with furrow irrigation and clean cultivation. The mulched basin is not satisfactory on heavy gumbo soil.

The set of fruit was very light throughout the Riverside district in 1915, owing apparently to cold weather following the bloom. In the Sunny Mountain tract, where the mulched basins were first installed in 1913, the average number of oranges per tree on the check trees in 1915 was 116, while on the mulched-basin trees the average number of oranges per tree was 281, or two and one-half times as many as on the check trees. The quality of the fruit on basined trees was also superior to that on the unbasined trees. In the Victoria tract in 1916, the alfalfa-mulched trees averaged 483 oranges, the manure-mulched trees 242 oranges, and the check trees 182 oranges. In the Eureka tract where the mulched basins had been installed the preceding autumn, the alfalfa-mulched trees carried, on the average, 550 oranges, an increase of thirty-three oranges per tree over the average yield of these trees for the preceding six years. Experiments in this tract with other mulching materials showed a decrease in yield during the first season, due in part at least to the fact that the new root system below the basins was not established at the time the first buds were set.

The new leaf growth on the basined trees was less mottled than the new growth on the unbasined trees after sufficient time had elapsed for the mulched-basin system to produce response in the tree growth.

The new leaves on the basined trees were larger and darker in colour, and had a better texture than those on the unbasined trees, especially on heavy soil.

The new growth of rootlets under the mulch in the basins was very much greater than in the check treatments, the soil in the basins being filled with rootlets to within about 2 inches of the surface.

Great numbers of earthworms were often found in the basins under the mulch, and their burrows honeycombed the entire soil mass. The worms helped to incorporate the organic material with the soil, while their burrows facilitate the absorption of water in heavy soils.

No soil crust of any kind has been found in the basins where the mulch completely covered the soil surface. A complete mulch must be maintained at all times, however, to prevent the surface from crusting.

The experiments indicate that alfalfa and bean straw are superior to stable manure for mulching purposes.

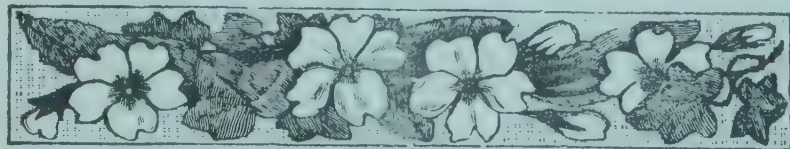
In the mulched basins the quantity of humus, as measured by the intensity of the colour of the alkaline extract, increased markedly in the first foot of soil during the summer, but no increase was observable at the greater depths. From seventy to 120 days were required for the mulch in the basin to decompose sufficiently to produce a measurable increase in the humus content. Alfalfa and manure mulches were equally effective in producing this increase in humus. Barley cover crops produced a marked increase in the humus content of the soil fifty days after being disked into the soil.

The use of an organic mulch moderates the rise in soil temperature during the day. The advantages of the mulch, however, are not wholly attributable to this fact, nor to the conservation of moisture. Wood shavings when used as mulching material afforded as much protection in this respect as alfalfa or bean straw, yet trees mulched with pine shavings gave yields less than half those obtained with mulches of alfalfa or bean straw.

Surface mulching with organic material, especially when available in quantities sufficient to cover the entire surface, may in the long run prove fully as effective as the use of the mulching material in basins. A more immediate response from the mulched basin may be expected, owing to the fact that each time the basins are flooded the soluble portions of the decaying mulch are carried with the irrigation water directly into the soil. In this respect the mulched basin resembles a surface organic mulch in humid regions where the rainfall first passes through the mulch before entering the soil. Many of the citrus soils of California contain so little active organic matter that it is essential to secure the advantages of the applied organic material at the earliest possible date, and this appears to be brought about more quickly by the use of the mulched basin than by organic mulches with furrow irrigation. The mulched basin also appears to be the most effective means of using a limited quantity of mulching material.

The marked response of citrus trees in the experimental tracts under the mulched-basin system justifies its serious consideration by citrus growers. It is still in the experimental stage, and its suitability to local conditions in any instance should be thoroughly tested in an experimental way, before installing basins on a large scale. Its final value in the industry can be determined only after it has been so tested in comparison with other systems in commercial practice.

An interesting paper on ascending the loftier Himalaya appears in the January issue of the *Geographical Journal*. It deals principally with the difficulties encountered, which are divided into (a) physiological difficulties, and (b) physical difficulties. The former concern principally the question of oxygen supply. The conclusion from experimental balloon ascents is that the ascent of Mount Everest (29,141 feet) without adventitious aids would be quite impossible, but from the fact that the physiological conditions of mountaineers and balloonists are not comparable, the balloonists having no opportunity of becoming acclimatized to high altitudes, it is considered possible to make a successful ascent of the highest mountain in the world without artificial aids to respiration.



SENILE DECAY IN PLANTS.

The importance of arriving at a decision as to whether senile decay takes place in plants as well as in animals, lies in its relation to the effects of continuous vegetative propagation on seed-producing plants. Senile changes in the leaves of *Vitis vulpina* and other plants have been studied at Cornell University by H. M. Benedict, and the general conclusions arrived at are summarized as follows in the *International Review of the Science and Practice of Agriculture*, for September 1916:—

The writer next draws conclusions from these observations, and in particular envisages their application to the question of the degeneration of plants reproduced by scions or slips; he lays stress on the interest attaching to investigations on this important question. Finally he examines and generalizes the theories of senility, in order to extend them both to the animal and vegetable kingdom. He rejects the theories relating to the localisation of senile modifications, including the theory of Metchnikoff on the part played by toxins secreted in the main intestine of animals, and in the flowers of plants. He likewise does not admit that old age is due to the accumulation of katabolic products, or to the decreasing elimination from the body of the products of secretion of cells placed far away from the surface. To him, old age results from a physical or chemical degeneration involving the protoplasm itself, producing among other changes a diminution of permeability, and he concludes that the evidence appears very strong, both from the point of view of senility and that of regeneration, that the duration of life is directly bound up with the degree of permeability found in that part of the living cell which is in contact with the surrounding universe, and that in proportion as the activities of life continue, the cell is entombed by an inexorable diminution in the permeability of its protoplasm. The fundamental cause of this diminution may very well be the colloidal nature of protoplasm. The relatively simple relations existing in non-living complex colloidal bodies tend to be modified under the action of external forces, or even by the mere action of time; it seems inevitable that the extremely complex colloidal states which form protoplasm should be modified progressively by the activities of life, and by the intervention of external forces. What should give rise to astonishment is not the senile modifications of the protoplasm, but their tardiness in appearing.

Regeneration is the process by which the original arrangement of the colloidal elements constituting the protoplasmic colloids is restored.

Sexual reproduction is one of the methods by which this regeneration is accomplished, while it is ensured by more primitive methods in asexual plants.

It is for the future to solve the question whether the progress of senility in sexed plants and animals can be arrested or even retarded by means of regeneration such as are utilized in asexual forms, and which are thus to a certain extent applicable to the whole of the somatic cells. The knowledge which we at present possess as to the cause of senile degeneration does not allow of a rash negation of the possibility of somatic regeneration.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
February 8, 1917.

ARROWROOT—2 $\frac{3}{4}$ d. to 4 $\frac{1}{2}$ d.
BALATA—Block, 2/6 to 3/3 $\frac{1}{2}$; Sheet, 3/9.
BEESWAX—No quotations.
CACAO—Trinidad, 79/-; Grenada, 60/. to 71/6; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£45 10s. to £46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 34d. to 36d.
FRUIT—Bananas, £17 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, 62/6 to 72/6.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed) 14/6.
LOGWOOD—No quotations.
MACE—11d. to 2/6.
NUTMEGS—6 $\frac{1}{2}$ d. to 1/6.
PIMENTO—3 $\frac{3}{4}$ d.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, 4/4 to 4/9.

New York.—Messrs. GILLESPIE BROS. & Co., March 15, 1917.

CACAO—Caracas, 12 $\frac{3}{4}$ c. to 13c.; Grenada, 13c. to 13 $\frac{1}{4}$ c.; Trinidad, 13 $\frac{1}{4}$ c. to 13 $\frac{3}{4}$ c.; Jamaica, 10 $\frac{1}{4}$ c. to 11 $\frac{1}{4}$ c.;
COCO-NUTS—Jamaica and Trinidad selects, \$37.00 to \$38.00; culls, \$23.00 to \$24.00.
COFFEE—Jamaica, 9 $\frac{1}{2}$ c. to 11 $\frac{1}{2}$ c. per lb.
GINGER—16 $\frac{1}{2}$ c. per lb.
GOAT SKINS—Jamaica, \$1.30; to \$1.35; Antigua and Barbados, \$1.20 to \$1.25; St. Thomas and St. Kitts, \$1.20 to \$1.25 per lb.
GRAPE FRUIT—Jamaica, \$1.50 to \$2.25.
LIMES—\$5.50 to \$6.00.
MACE—38c. to 46c. per lb.
NUTMEGS—22c.
ORANGES—\$1.75 to \$2.50.
PIMENTO—5 $\frac{1}{2}$ c. per lb.
SUGAR—Centrifugals, 96°, 5.39c; Muscovados, 89°, 4.78c.; Molasses, 89°, 4.33c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., February 23, 1917.

CACAO—Venezuelan, \$14.00 to \$14.25; Trinidad, \$17.28 to \$17.76.
COCO-NUT OIL—\$1.45 per Imperial gallon.
COFFEE—Venezuelan, 12 $\frac{1}{2}$ c. to 14 $\frac{1}{2}$ c.
COPRA—\$7.25 per 100 lb.
DHAL—No quotations
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$8.40 to \$8.75; White, \$9.25 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., March 2, 1917.

ARROWROOT—\$5.00 per 100 lb.
CACAO—\$11.50 to \$12.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, \$112.00 per ton.
MOLASSES—No quotations.
ONIONS—\$4.50.
PEAS, SPLIT—\$10.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$8.55; Patna, no quotations; Rangoo, no quotations.
SUGAR—Muscovado centrifugals, \$4.50.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, Barbados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles „ Cordwood		



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Waste Land and Wasted Land.

A CERTAIN proportion of the land on every estate adds little or nothing to the estate income. Some of this non-productive land, known as waste land, can be rendered productive by a sufficient outlay of capital and labour. Many waste areas, however, owing to natural conditions, can never be profitably reclaimed or utilized, no matter how efficient the management.

Other areas may be termed wasted areas; that is, misused or inadequately utilized, so that they bring in little or no real return. At the same time areas which do not bring in a direct income in money may not necessarily be regarded as waste or even wasted areas.

A consideration of these facts is important in the West Indies.

In the mountainous islands the unproductive land on estates is generally forest land. From the point of view that this land yields little or no direct return, it may be regarded as waste. On the other hand, the beneficial effects of forest in the matter of checking soil wash, and in conserving the rainfall may not be disregarded. Forest land belonging to and adjoining estates is often left untouched because the situation occupied possesses unfavourable features as regards transport, but it is thought that in many places something might be done to substitute trees yielding economic products that can be conveniently collected and transported at leisure. In this connexion rubber and bay trees, Kola and logwood may be suggested. Very often clearings are made for the cultivation of provision crops by the peasantry. This is to be particularly encouraged at the present time.

In the islands which are not mountainous the waste land belonging to estates is characterized by a very dry, thin or unfertile soil, generally with the underlying rock exposed in places. In the volcanic islands this land may also occur, often strewn with boulders which render systematic cultivation difficult, if not impossible. Such land, which generally possesses a scanty covering of

grass, is used for grazing live stock, and is known under the somewhat grandiloquent term of pasture. It is, therefore, not waste land strictly speaking, but its productive value is very small indeed. Possibly it might be improved by feeding more concentrated foods like cotton-seed meal to the animals while grazing. Some of this land which possesses, in places, very fertile pockets of soil, might be used for the cultivation of certain plants that do not require very special conditions of environment, and will withstand periods of drought—for example, Ajowan (*Carum copticum*) which yields thymol, and possibly some of the Sorghums.

A good deal of such waste land in fairly moist localities might be used for growing green dressings for mulching cacao and limes.

Though it is difficult in practice to draw a hard-and-fast line between waste and wasted land, the latter, as already stated, may be considered as land which is mismanaged. The chief instance of such mismanagement is seen on estates where an attempt is made to grow crops that are unsuited to the natural conditions that obtain. The cultivation of limes in certain exposed situations is a specific instance of what is meant, so is also the cultivation of susceptible varieties of cacao in the West Indies and the planting of rubber trees in places that are too dry for this tree. Such misutilization of land is by no means uncommon, and there is always a strong tendency in this direction when the market prices connected with a certain crop rule high for any considerable period.

It is frequently a matter of argument as to whether the unoccupied spaces in orchard cultivations are wasted land. In Trinidad, for example, there appears to be a tendency to plant mixed cultivations, for instance, coco-nuts with limes, and coco-nuts with sugar-cane. Generally speaking this practice is not found to answer. The cultivation of green dressings is another matter, for here the manurial factor enters into the question.

A considerable area is occupied on some estates by shade trees and wind-breaks. Although these trees yield no direct return in money, the land is not by any means wasted, provided such shade and shelter is necessary. In fact the establishment of such means of protection adds greatly to the capital value of the estate, and is intimately bound up with the yields of produce obtained.

The same conclusion holds good in regard to fences, hedges and drains.

In arable cultivations experiments have been made to see if very close planting is really economical. There appears to be a limit to the mutual proximity at which plants can be economically cultivated. What might appear to be wasted land between the plants is not always so, for these areas are occupied by the root systems of the growing crop. However, it may be suggested that Indian corn could be planted rather closer than it is in most places in the West Indies, and a crop like onions might very well be grown more generally in cane fields.

The foregoing considerations will serve as a guide in directing attention to the question of waste and wasted land on the estate. It will be realized that in some places the labour factor must enter into the question and determine to a large extent the limit to which unproductive land can be profitably utilized. Whatever the local circumstances, on every estate a clear understanding should be arrived at as to the relative productivity of the lands composing it, and every effort should be made to derive as much benefit as possible from the poor land as from the rich.

Wheat Cultivation in the Tropics.—This is a subject to which considerable interest attaches at a time when the shipment of flour from northern countries is becoming increasingly difficult. It is noted in the Annual Report of the Department of Agriculture, Uganda, 1915-16, that at the Experimental Station, Fort Portal, Toro, $\frac{1}{2}$ -acre of wheat was sown in May 1915 and another $\frac{1}{2}$ acre in June; the former was the better, though neither of them proved very successful owing to 'rust'. The report states that it is hoped to pay more attention to the wheat crop when circumstances permit. It should be mentioned that the Experiment Station where these trials were made is 5,000 to 5,500 feet above sea-level, which accounts for the possibility of making wheat cultivation successful in these tropical regions.

It is stated in the *Annual Trade Review* for 1916 of the London Chamber of Commerce, to which reference is made on another page in this issue, that the year 1916 has been one of extreme difficulty in all industries which use sugar as a raw material. While the demand for confectionery has been fairly maintained, both in the home and export market, the greatly reduced sugar supplies which have been available for manufacturers have necessitated a very large diminution in output. It appears that last year the English fruit crop was disappointing, and this has reduced the supply of jam, the price of which it is expected will rise steadily until the fruit crop of the present year has been harvested. Even then the restrictions on the use of sugar must lead to a very considerable reduction in the output of jam, but more especially chocolate and other forms of confectionery. In view of this, every effort ought to be made in the West Indies to make as much preserves as possible, including marmalade, from locally grown fruit.

SERIOUS SUGAR SITUATION IN CUBA.

The following editorial remarks are made in the *Louisiana Planter* for March 24, concerning the Cuban insurrection:—

Our latest advices from Cuba indicate conditions that we believe are not appreciated by the sugar trade generally. The enormous development in the sugar industry during recent years has occurred in the eastern part of the island, say generally beyond Nuevitas. With the railways suspended, with indefinite reports as to the thousands of acres of cane fields that have been burned by the insurrectos, thought by some to reach hundreds of thousands of acres, the lack of communication and the indisposition to circulate any depressing or evil news, and especially any such news as would cause American intervention, have all combined to keep the outside world considerably in the dark as to the true situation in the great sugar production sections in Eastern Cuba. It will have been noted that very little damage has been done to any of the sugar factories. The insurrectos have apparently concentrated their attention on the burning of the cane fields. This burning would destroy but one crop, and in that one crop but little money would be invested and hence the damage not very great in actual dollars of expenditure. Such damage would of course diminish the profits of the great central factories which would be and will be without supplies of sugar-cane, and the material cutting down of the sugar crop would, of course, enhance the value of sugars throughout the world.

We are without actual knowledge with which to express any satisfactory opinion, but it will be noted that the Cuban statisticians who are naturally disposed to exaggerate the Cuban crop, have already reduced their estimates to less than 3 millions of tons against their former expectation of $3\frac{1}{2}$ millions of tons. While an actual determination of the size of the crop can only be had when the crop shall have been finished, yet we have learned from authority quite conversant throughout the island, that the enormous injury done to the cane crop in the eastern end of the island not only may, but probably will, cut the coming Cuban crop down to $2\frac{1}{4}$ millions of tons, if not down to 2 millions of tons. When we reflect that the climatic conditions in the United States will cut our corn crop down from 20 to 30 per cent. all over the country, and that in Louisiana climatic conditions will sometimes cut our sugar production down one-third, we can readily see that the present conditions prevailing in Eastern Cuba, combining as they do the maturity of the sugar-cane, its arrowing and sequential deterioration, the approach of the summer rainy season, the insurrectionary feeling generally prevailing and the many thousands, and as we have indicated possible, the many hundreds of thousands of acres of sugar-cane that have already been burned in the fields, lead us to think seriously of the possibility, if not the probability, that the coming Cuban sugar crop will fall to nearly as low as 2 millions of long tons of ultimate sugar production.

It is not generally known in the temperate zone that in the tropics where sugar-cane is cultivated, it is usual to leave on the ground, or to place there, immense quantities of cane trash, the leaves of the preceding cane crop, in order to retain in the ground the necessary moisture, and in order to prevent the growth of weeds and thus to avoid the cost of cultivation, such as we effect in Louisiana to suppress weeds. This immense body of cane trash on the ground, once fired and that done in tolerably dry weather, the extent of the conflagration is so serious as to actually destroy the cane. Sometimes in Louisiana with certain varieties of cane

difficult to cut, we have burned off the cane trash in order to reduce the cost of cutting in. In Cuba such a burning becomes a serious matter, owing to the possible spread of the fires and the destruction of the cane itself. There is very little news extant concerning these conditions, but of their gravity there can be no doubt.

CONVERTING PASTURE TO ARABLE CULTIVATION.

The Board of Agriculture of England and Wales is urging farmers, in so far as it does not seriously interfere with the maintenance of live stock, to plough up their pastures in order that more food crops may be grown. It is possible that similar proposals may be suggested in the West Indies should the supply of foodstuffs become very critical, though it has to be remembered that the relative area under pasture in the West Indies is very small and occupies land which is generally the poorest rather than the best, as is not the case of England.

Converting pasture to arable cultivation presents difficulties. The means of overcoming some of the difficulties are explained in the *Journal of the Board of Agriculture of England and Wales* for February 1917. The three principal difficulties are: (1) that of making the freshly broken turf consolidate upon, and establish intimate contact with, the subsoil; (2) the insect pests which may be present in the turf, and which may attack and destroy the crop; (3) the manuring of the land.

The consolidation of freshly broken turf is brought about by careful ploughing and subsequently pressing the furrows by means of the wheels of a heavy cart or similar appliance driven immediately behind the plough. In ploughing it is not merely sufficient to turn the furrows half over; they must if possible be completely inverted so as to bury all the grass. This is best brought about by emulating the work of the Kentish plough and ploughman by using not the ordinary iron plough but a type of long-breasted plough.

Regarding insect pests, little can be done other than to delay planting until a good tilth has been secured so that the young plants may readily 'grow away from' the attack of any pest that may be present.

In connexion with the quick growth of the crop in its early stages to enable it to resist insect pests, manuring is of the utmost value. It is recommended that for corn crops, sulphate of ammonia and superphosphate (the latter to stimulate root development) should be applied. Although not mentioned in the article under notice, it is likely that a dressing of lime would tend to improve the texture of the soil, increase bacterial activity, and to some extent exert an insecticidal effect—all of which would tend to benefit the crops it is desired to grow.

Sugar-cane in Uganda.—Sugar-cane is receiving more attention and many new varieties have been introduced from various parts of the world for experimental purposes. At present it is chiefly grown in small patches by natives for consumption in the green state. It is mentioned that on two estates the crop is cultivated for making into unrefined sugar for local sale, a little only being exported. Conditions are favourable for a considerable extension of sugar-cane cultivation. (Annual Report of the Department of Agriculture, Uganda, 1915-16)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADE. Reporting for the months of February and March, Mr. J. C. Moore, Superintendent of Agriculture, mentions the harvesting of plots in the Experiment Stations and transplanting of lime seedlings (24,000) in the Botanic Station as among the chief operations for the period. Plant distribution included 1,599 lb. of horse beans. Staple crops were making satisfactory progress, while ground provisions were plentiful. The sugar-cane crop is expected to be less than last year. Stored Indian corn is reported to be keeping well. Proposals have been submitted to the Government and the Board of Agriculture for a prize competition in Carriacou for improved cotton cultivation. The rainfall in February was rather above the average for that month, while the weather in March is reported as showery.

ST. LUCIA. Mr. A. J. Brooks, the Agricultural Superintendent, in his report for the month of February, states that work in the Experiment Stations included the erection of a galvanised building 30 x 20 x 18 feet and the installation of the necessary machinery for the manufacture of potato meal and farine on a commercial scale. Plant distribution comprised mangoes, budded oranges, 105 ornamental, and 299 lime plants. Work in the Botanic Gardens was of a general routine nature. With regard to the staple crops, reaping operations were still in progress.

Public meetings were held by the Inspector of Agricultural Credit Societies in Laborie and Vieux Fort for the purpose of forming societies in these districts. Seven Agricultural Credit Societies have already been registered and are doing excellent work in the island.

The Agricultural Superintendent further reports that work in the Experiment Stations in March included the planting of cassava, sweet potatoes and cane, etc., also the harvesting of various seeds, spraying and sowing lime seeds and completing the cane crop. Plant distribution consisted of 6 Julie Mango plants, 20 budded oranges and 16 decorative. In the Botanic Gardens the chief work performed during the month was the continued opening up of the drains to the sea, potting, mowing, harvesting of seeds and the planting and manuring of flower beds. As regards staple crops, the reaping of cacao and cane continues; the lime crop being over and the trees all flowering.

The Agricultural Officers continued their visits to various estates and small holdings urging the planting of food crops. The Agricultural Assistant spent nine days on a large cacao estate training the overseer and labourers in pruning, draining, and treating certain cacao diseases. The Agricultural Superintendent accompanied His Honour the Administrator to Gros Islet on March 17, where His Honour addressed a public meeting and urged the peasants to plant up their available land. Visits were paid to the districts of Castries, Gros Islet, Marquis, Union, Anse-la-Raye and Soufrière in connexion with agricultural instruction. His Honour, R. Popham Lobb, C.M.G., arrived in the colony during the month and assumed the duties of Administrator. The question of enlarging the present Government sugar works at Réunion and installing modern machinery for the manufacture of a superior grade of sugar is one of the many schemes already engaging the serious attention of the Administrator for the general agricultural advancement of the colony. It is proposed that this scheme should be run on a co-operative basis similar to the Government Lime Juice

Factory at Castries, and judging from the reports already received from planters and peasants it is likely to prove one of the most popular schemes attempted for the general advancement of the agricultural population in the southern districts of the island.

The rainfall was 2.79 inches at the Botanic Gardens, Castries, and 1.24 at Choiseul.

DOMINICA. Mr. J. Jones, the Curator, reports that four of the citrus plots at the Experiment Stations were drained and bedded off. At the Lime Experiment Station picking and recording crop operations for the year were completed, and cutlassing and weeding carried out. At the Cacao Experiment Station, the Curator was engaged in weeding, picking and recording the crop. Fifteen bags of cacao were shipped to London during the month. The following plants were distributed: limes, 2,175, coffee 500, cacao 50, budded citrus 6, miscellaneous 4, total 2,735. A second batch of 40,000 cane plants was received from Guadeloupe and distributed from the Botanic Gardens. Work in the nurseries comprised repairing and recovering shaded nurseries, lifting plants, weeding and cutlassing, budding limes and other citrus. As regards staple crops, a good carême cacao crop is said to be seen on the trees. Green limes were scarce and the price locally has advanced from 8s. to 23s. per barrel. Lack of shipping facilities is said to have caused the price for raw lime juice to drop from 1s. to 5d. per gallon. The average price paid locally for yellow limes during the year 1916-17 was 4s. 6d. per barrel.

The Government has made certain suggestions for controlling and improving the standard of the green lime trade, which if generally adopted will effect great improvements.

A severe outbreak of *Diplodia* was reported on cacao. The estate affected was visited by the officers of the Département and suggestions offered to improve the position. High winds and absence of shelter belts were the primary cause of the outbreak. Thrips were fairly common in the same locality.

Experiments were conducted in diluting wheat flour with farine meal for bread making. Land was cleared for the extension of the coco-nut experiment station. Samples of lime juice were tested and experiments conducted to determine the economic point of washing sludge in the preparation of clean concentrated juice.

The rainfall for the month was 6.74 inches, of which 5.68 inches fell in the first six days of the month.

MONTSERRAT. Work in the Experiment Station was chiefly of a routine nature owing to dry weather. Plots were prepared for future crops and seed beds and plants watered. Further spraying was necessary on the lime experiment crop. A few hundred acres of cotton were planted early in the month and a large portion of the crop would have been planted if rain had fallen. The desire to plant early (March and April) was a satisfactory feature in connexion with the cotton crop. Small planters have never before shown so much activity in the cultivation of cotton, though it is feared that the growing of food crops is being neglected. Sales of lint have been effected at 35d. and 36d. The special H. 9 cotton seed to plant the seed fields was distributed; five samples of cotton lint sent to England for spinning tests were very satisfactorily reported on, and it would appear that the quality of Montserrat cotton has steadily improved in recent years. Cotton breeding work in 1917 will consist of the cultivation of fifteen special plants of the H. 9 strain, seven plants of the Douglas No. 1 strain and two plants of the St. Kitts No. 342 strain.

Onions were continued to be shipped to Canada and West Indian markets by the Montserrat Onion Growers' Association.

The latter part of the month was particularly dry, the total rainfall registered 3.98 inches.

ANTIGUA. The following plants were distributed by the Curator, Mr. T. Jackson: 3,198 sisal, 107 coco-nuts, and 10 miscellaneous; 12 packets of seed were also distributed.

Work in the Botanic Gardens consisted in the transplanting of a large number of bay plants and cane seedlings; ordinary routine garden and nursery work was also performed. The reaping of the crop is in full swing and good returns are, on the whole, being obtained from fields of plant canes, while ratoon yields were indifferent. Rain is required for all crops. The young canes are showing the effect of protracted drought.

Sisal planting has been continued in the Windward District of the island and the reaping of onions is practically over. Sugar exported in 1916, amounted to 18,542 tons, of which 3,613 were muscovado.

During the month 2,000 lb. approximately of seed-cotton were purchased and 4,072 crates of onions were shipped. Laying out of plots at Sawcoats continued.

The rainfall for the month was 1.17 inches; rain is badly wanted.

VIRGIN ISLANDS. Mr. W. C. Fishlock writes to say that the chief work in the Experiment Stations during the month of February, was that of clearing away debris left by the hurricane of last year, repairing roads, fences, etc. Holes were also dug to replace damaged coco-nut trees as soon as favourable weather occurred. Plant distribution was confined to a few ears of corn and 36,000 onion seedlings. The damage done to the cotton crop appears to have been such that there is but little hope of a second crop of any size; but little seed-cotton has been coming in. No limes are coming in or are likely to. Advantage was taken of a visit to Anegada to advocate the cultivation of onions in that island. Weather was reported dry, the total rainfall for the month being 1.52 inches.

NEVIS. In his report for the month of February, Mr. W. I. Howell, Agricultural Instructor, mentions the reaping of crops on various plots in the Experiment Stations, which gave good returns. From the Botanic Station, the following plants, seeds, etc. were distributed: Para peas 34 lb., Lima beans 30½ lb., Guinea corn 15 lb., Black-eye peas 4½ lb., Indian corn 1½ lb. The cane crop throughout the island was being reaped; nearly the whole crop has been sold to the St. Kitts Factory. Young canes, on the whole, were doing well. The reaping of the cotton crop was almost completed, and preparation for planting next season's crop was in progress. A fair acreage was planted in sweet potatoes and peas during the month. The Agricultural and Commercial Society has been re-organized, the Hon. C. C. Greaves being elected Chairman, with Mr. E. Williams as Hon. Secretary. Rainfall for the month was 3.28 inches.

The report on the sugar-cane experiments in the Leeward Islands for 1915-16 has just been issued by the Imperial Department of Agriculture and the contents will be reviewed in the next issue of this Journal. The report is published in the usual form and gives the mean results of trials with seedling varieties, and the mean results of manurial experiments carried on at the different stations. As in the past, the present report contains information of great importance to sugar planters, especially in Antigua and St. Kitts-Nevis.

INSTRUCTION AND EDUCATION IN ANTIGUA.

In the West Indies, agricultural instruction is understood to mean practical demonstration and advice in agricultural operations and methods for the benefit of the peasantry. This important work has been provided for in several of the islands for many years past, but it has only recently been introduced into Antigua. As well as instruction work, guidance in regard to reading courses and practical studies in horticulture have been arranged for cadets in all the islands. The following statement taken from the Report on the Agricultural Department, Antigua, for 1915-16, indicates the position in that island during the year under review:—

The number of peasant holdings in Antigua have steadily increased during the last few years, and although these in the past were visited periodically by the Curator, it was felt that the amount of work of this description that could be done by this officer was limited by recent additions to his duties. Consequently at the time of writing, the work of agricultural instruction has been undertaken by the 1st Assistant for Agricultural Experiments working under the general direction of the Curator. It is intended that this officer shall at least one day each week for a proportion of the year visit peasant holdings, and when on the land discuss with the owners any problems connected with practical agriculture that they may bring forward.

The English Harbour District will be the part of the island in which this work will be conducted. Afterwards, possibly other districts will receive attention.

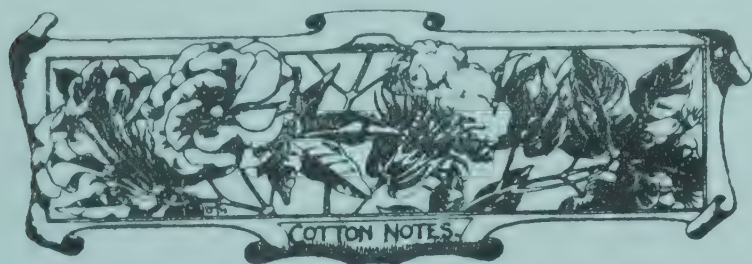
Although this work has only been carried on for a very short space of time, there are indications that useful results will be obtained.

AGRICULTURAL EXAMINATIONS.

Four candidates presented themselves for the examination in Practical Agriculture held in November 1915. Of these two sent in papers of such poor quality as to lead to their rejection by the local examiners.

In the Preliminary Examination E. F. Shepherd obtained a second class certificate, and in the Intermediate Examination A. Gallwey obtained a first class certificate.

Figures furnished by the Acting Chemical Assistant, St. Kitts, indicate the high nutritive value of sweet potatoes grown in that island. According to his analysis, locally prepared sweet potato meal contained nearly 5 per cent. of crude proteins, over 1 per cent. of fat, nearly 78 per cent. of carbohydrates, 2 per cent. of fibre, 2.5 per cent. ash, and 11.7 per cent. water. Locally prepared white bean flour contained over 23 per cent. of protein and nearly 3 per cent. of fat. The per cent. of fat in white bean flour is much less than that found to exist in crushed velvet beans, namely, 5.2 per cent. The per cent. of carbohydrates in both beans was less than in the sweet potato meal. There is not much difference in the nutrient value of the three foods, but there is a very considerable difference in the nutrient ratio on account of the fact that the beans are very much richer in flesh-forming constituents than the sweet potato meal.



COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ending March 24, 1917, is as follows:—

ISLANDS. There has been a demand for the few Planters' crops remaining unsold, resulting in the sale of them for export; consequently the entire crop has now been disposed of and quotations are based only on last sale made, viz:

Extra Fine odd bags	58c. = 60c. landed
Fine to Fully Fine	55c. = 57c. „

GEORGIAS AND FLORIDAS. The market remains strong with active demand for all offerings, which are now much reduced and consist very largely of the lower grades, viz.: Common to Choice. The sales in Savannah were limited to these lower grades, but some lots were sold in the interior markets on a basis of average Extra Choice at 60c. Since the active demand during the last three weeks, resulting in large sales, aggregating over 10,000 bales, prices having advanced in all about 9c., the stocks everywhere are reduced and firmly held for even further advance. The unsold portion of the crop is now estimated at about 6,500 bales to 7,500 bales.

This urgent and excited buying on account of the Northern Mills is due to the difficulty of getting Egyptian cotton, the English Government having put an embargo on all such shipments from Liverpool.

We quote, viz:—

GEORGIAS AND FLORIDAS.

Extra Choice to Fancy	60c. = 61½c. landed.
Choice to Extra Choice	59c. = 60½c. „
Fine and Extra Fine	58c. = 59½c. „
Common	53c. to 55c. = 54½ to 56½c.

The exports from Savannah for the week have been, to Northern Mills 1,323 bales, Southern Mills 84 bales, and from Jacksonville to Northern Mills 1,430 bales.

On March 20, the U. S. Census Bureau made its final report of cotton ginned to March 1, viz:

South Carolina	3,486 bales	} making a total of 117,544 bales.
Georgia	77,966 „	
Florida	36,092 „	
Against last year	91,920 „	Total crop
„ 1915	81,598 „	85,278 „
„ 1914	77,490 „	78,857 „
„ 1913	73,641 „	85,544 „
		66,169 „

LONG-STAPLE COTTON IN 1915-16.

In addition to the wealth of statistics and other information characteristic of previous reports of this nature, Bulletin 134, recently issued by the Department of Commerce, Bureau of the Census, entitled 'Cotton Production and

Distribution, Season of 1915-16', contains considerable information of interest to manufacturers of automobile tire fabrics. Several quotations selected from various sections of the Bulletin have been pieced into the following continuous narrative:—

The limited supply of cotton having a long staple, and the world-wide demand for cotton of this character in the manufacture of thread and the higher grade fabrics, and recently of automobile tires, have given such varieties an importance seemingly out of proportion to the amount produced. While at one time long-fibre Sea Island cotton grown in the West Indies provided a large part of the total used in Europe, the world's production of this variety at the present time is comparatively insignificant, averaging less than 100,000 bales per annum. The quantity of long-fibre cotton produced in Egypt last year was less than a million bales, and the quantity of Upland cotton with a staple of 1½ inches or more in length produced in the United States from the crop of 1915, according to the estimate of the Department of Agriculture was about 825,000 bales. Long-staple cotton is also produced in comparatively small quantities in India, Brazil, Peru, and several other countries. Altogether the total of long-staple cotton—that is, cotton having a fibre of 1½ inches or more in length—produced throughout the world from the crop of 1915 did not, in all probability, exceed 2,000,000 bales.

The 1915 crop of Sea Island cotton is given as 91,844 running bales, divided as follows: Georgia, 57,572; Florida, 28,094; South Carolina, 6,178. Of this total 5,824 bales were exported. The 1916 exports, however, were only 3,580 bales.

It might be presumed that the prices generally received for Sea Island cotton would cause a large increase in the acreage, but attempts to grow it in other parts of Georgia, Florida, South Carolina and other States have been so unsatisfactory that practically all efforts to raise it outside of certain well-defined areas in the States named above have been abandoned.

Of the total consumption of cotton in the United States during the year ending July 31, 1916, amounting to 6,397,613 running bales, 82,645 were Sea Island and 316,995 foreign. A very large proportion of the foreign cotton consumed was Egyptian. Imports of Egyptian cotton by American manufacturers have led to efforts to grow in the United States cotton having its characteristics, and some encouragement has been given the movement by the success attending its culture in Arizona.

The status of the cultivation of the Egyptian varieties of cotton in this country is presented in the following statement, prepared by the Department of Agriculture.

The abnormally low prices of 1914 caused a greatly diminished acreage to be planted in Egyptian cotton in Arizona in 1915. The total production last year amounted to only about 1,100 bales of 500 lb. each. This small crop sold at a much better price than in 1914, and consequently the acreage planted in 1916 increased to about 7,000 acres. A crop of about 4,000 bales is anticipated this year. The improvement in methods of production which is taking place as the farmers of Salt River Valley become better acquainted with this crop will probably result in larger average yields per acre than have previously been obtained. In view of the strong demand for the type of cotton (Sakellarides) with which the Arizona product is most nearly in competition, the prospects for the permanent establishment of the Egyptian cotton industry in that State are better than ever. (*India Rubber World*, March 1, 1917.)

SOME FRUITS GROWN AT BAHIA IN BRAZIL.

With its rich soil, mild climate, and abundant rainfall Bahia is pre-eminently suited to fruit culture. That the Brazilians have not been neglectful of this fact is evidenced by the large number of species cultivated, some of them indigenous to the region and others introduced from the Orient by the Portuguese in the early days of colonization. Fruit forms an important item in the diet of the people, and the abundance and variety offered in the markets are a constant surprise to visitors.

With the exception of the orange and the pine-apple, of which there are extensive commercial plantations, nearly all fruit trees are grown near the houses and in the gardens of the natives, either as single specimens or in small numbers, frequently crowded together without regard to order. Under such conditions the trees receive very little attention; yet their growth is usually vigorous and their appearance indicative of health.

The Indian tamarind (*Tamarindus indica*, L.) is common, the fruit being used principally for making a cooling drink. The Carambola (*Averrhoa carambola*, L.), another Indian fruit is also cultivated, but is not very common, *Phyllanthus acida* (L.) Skeels, known as Groselha ('gooseberry'), is seen in many gardens. The avocado, locally called abacate (*Persea americana*, Mill.) is one of the most popular of fruits during its season and is cultivated on a commercial scale, one grove alone containing nearly 800 trees. Budding or grafting is not practised. Among the seedlings none was seen which appeared to be superior to those grown in Florida and the West Indies. The caja and the caja mango (*Spondias lutea*, L. and *S. cytherea*, Sonnerat) are seen occasionally at Bahia; both are used for making sherbets as well as eaten in the fresh state. The sapodilla, locally known as sapoti (*Achras sapota*, L.) grows to large size and its fruit is highly esteemed. Two varieties are distinguished by the natives, one oval or elliptical, and the other round. One or more species of Passiflora, known as maracujas, are occasionally seen, as is the jambo, or rose-apple (*Coryophyllus jombos* (L.) Stakos).

The papaya (*Carica Papaya*, L.), known in Portuguese as mamao, is esteemed as a breakfast fruit. Two forms are distinguished, a small, usually round or oblate type, known simply as mamao, and a large, elongated form known as mamao da India. The latter is considered much the better in quality and always brings a good price in the market. When the fruits are picked it is customary to make four or five shallow incisions through the skin from base to apex and then to allow twenty-four hours or more for the milky juice to exude before the fruit is eaten. This tropical custom is said to improve the flavour of the flesh. Propagation is usually by seed, though in rare instances the mamao da India is said to be grown from cuttings in order to insure its coming true to type.

The common guava of the tropics (*Psidium guajava*, L.) used principally for jelly making, is present in many of the gardens. The manufacture of jelly is carried on commercially but not on so large a scale as in the State of Pernambuco, farther north. Several indigenous species of *Psidium*, known as Araca do Rio, Araca cageo, etc., are also grown to a limited extent.

The pine-apples of Bahia (called abacaxi in Portuguese) are justly renowned; one author describes them as 'mellow and over-running with juice of incomparable flavour.' By the Brazilians they are considered inferior only to those of Pernambuco. During the height of the season they are brought in boatloads across the bay from the mainland and heaped up in large piles at the waterside or in the markets.

The jak of the Malaysians (*Artocarpus integra*, (Thumb.) L. f.), here known as Jaca (Jack fruit), which, like the mango, was introduced by the Portuguese in the early days, is not only eaten and appreciated by the lower classes but when abundant is utilized as stock food. Cattle appear to be especially fond of it. The dried pulp, candied, wrapped in tinfoil, and packed in boxes holding about a pound, has recently been put on the market. The fruta de pao, or breadfruit (*Artocarpus communis*, L.), is not as common as the Jaca, or Jack fruit, but is grown in many gardens.

Of annonaceous fruits there are several, of which the most important is the fruta de conde (*Annona squamosa*, L.), so named, it is said, because of its having been introduced about the end of the seventeenth century by the Conde (Count) de Miranda. The fruits grown here are of large size and excellent quality. A rare species, *Annona salzmanni*, A. DC., usually known under the name of araticum, was seen in several gardens near Cabullo and Retiro. The fruits are about the size of those of the Custard-apple (*A. reticulata*, L.), with white, rather insipid flesh. They are occasionally sold in the market.

A number of other important fruits are grown or occur wild in the region about Bahia. These are described somewhat in detail, since they deserve to be called more particularly to the attention of American Horticulturists.

THE GRUMIXAMA.

Among the cultivated myrtaceous fruits the grumixama or grumichama (*Eugenia dombeyi*, (Spreng.) Skeels); *Eugenia brasiliensis*, Lam., is one of the most interesting. It is sometimes called the 'cherry of Brazil', a term which not inaptly describes its appearance and taste. The tree, 20 to 25 feet in height, is shapely and attractive in appearance, with ovate-elliptical, glossy, deep-green leaves 2 to 3 inches in length. The small white flowers are followed by pendent fruit, round or slightly flattened, about $\frac{3}{4}$ -inch in diameter, glossy, deep crimson in colour, crowned at the apex by the persistent green sepals. The thin, delicate skin incloses a soft, melting pulp of mild and agreeable flavour, strikingly suggestive of a Bigarreau cherry. The seeds are rounded or hemispherical when only one or two are present; sometimes there are three or more, in which case the size is reduced and they become angular.

The rapidity with which the fruits develop is surprising; within a month from the time of flowering they have reached maturity and are falling to the ground. Tavares states that the trees even of the same variety, do not at all ripen their fruit at the same time, some blooming much later than others and thus extending the season from November to February. Three varieties are distinguished, the difference being in the colour of the pulp; in one in its dark red, in another vermilion, and in the third white. All three are said to be of equally good quality.

The grumixama is much more common in southern Brazil, particularly in the States of Panama and Santa Catharina, than it is at Bahia. Little attention is paid to its culture, but it is said to prefer a deep and fertile soil. Its propagation is entirely by seed, the trees coming into bearing at four or five years of age.

The fruit is usually eaten while fresh, but it is well adapted to the preparation of various sorts of jams and preserves, in the manufacture of which the Brazilians are unusually adept.

(From United States Department of Agriculture, *Bulletin No. 445*.)

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of
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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue deals with considerations concerning the use of waste lands on the estate, and the better management of land already under cultivation.

On page 115, will be found an article explaining how the difficulties of converting pasture to arable cultivation may be overcome.

Important results of manural experiments with arrowroot appear summarized on page 125.

Insect Notes in this issue deal with the spread of the pink boll worm; under Plant Diseases will be found a survey of the diseases prevalent during 1916.

Stories in Agriculture.

For many years the Ontario Department of Agriculture has devoted much attention to the teaching of Nature Study in the schools of that Province. One of the more recent efforts in this connexion is to popularize Nature Study by means of Agricultural Stories. With this end in view Bulletin No. 243 has been issued. It contains several very original accounts of objects of country life. Reference may be made especially to Professor Cheelman's opening dialogue between a Father and Son on Nature Study itself, in which the boy displays his knowledge of the subject obtained at a School Fair and incidentally exposes his Father's ignorance. The Story of Raindrops by Professor Day in which a number of drops are personified and made to speak is quite clever, as is also Mr. Reed's 'Autobiography of Tomboy.' Tomboy is a four-year-old filly who describes her upbringing in a very human-like way, which is quite entertaining and instructive. In fact all the stories are good; and the ideas involved in the Bulletin might well be utilized for the purpose of teaching nature study in the tropics.

A special feature of the Bulletin is the excellent Figures illustrating the text.

Pearls in Coco-nuts.

The best-known home of pearls is the oyster shell, though very fine pink pearls are found in conch shells; common on West Indian beaches. The *Queensland Agricultural Journal* makes reference to pearls in coco-nuts. It says:—

'In 1911, the then Governor of Queensland (Sir William MacGregor) obtained from Mr. T. A. Williams, of Sabai Island, Torres Strait, valuable information on the subject of the diameter of space to which root cords spread out from the base of coco-nut trees, and courteously handed the report to us for publication. This appeared in the October issue of the Journal, 1911.

'Whilst discussing the root question, His Excellency informed us that in Hawaii (or Fiji?) he had been handed a coco-nut for his refreshment, and that he found inside it a valuable pearl. He saw the coco-nut opened, and was quite sure the pearl was not dropped into it. He gave the pearl to a lady present, who afterwards wore it at some Court function in London. Singularly enough, to-day we find in a book on "Tropical Agriculture," by Dr. H. A. Alford Nicholls, the following remarkable confirmation of the existence of pearls in coco-nuts. The author says, when describing the various parts of the nut: "Finally a very singular and highly-prized pearl is found, under very rare circumstances in coco-nuts, and a specimen has lately been added to the Museum of the Royal Gardens at Kew (1892)."

Exportation of Rice Prohibited from Demerara.

The Barbados *Advocate* for Friday April 13 has an editorial on the above subject, and draws attention to the effect which the decision to prohibit the exportation of rice except by licence will have upon the neighbouring West Indian colonies. It is understood, however, in certain quarters, that the prohibition is likely to be only temporary, and has been imposed with the object of enabling the British Guiana Government to collect a reserve supply in order to strengthen the security of its own position in the event of any serious shortage of imported foodstuffs, particularly cereals.

The extent to which neighbouring colonies are dependent upon British Guiana for rice is considerable. In 1915, Barbados alone imported 13,615,266 lb. of rice, of which 10,304,120 lb. was for local consumption. The amount credited to British Guiana was 5,415,229 lb. or more than half the amount locally consumed. The *Advocate* expresses the opinion that there is need at the present time for a certain amount of 'correlation of action, and of interchange of opinion' between the different Governments in regard to the food-supply question particularly; this view has been expressed editorially also in the *Agricultural News*. If Barbados is unable to get rice from Demerara, the *Advocate* says Barbados must retaliate and prohibit the exportation to Demerara of sweet potatoes. This kind of tit-for-tat policy however is not in keeping with the gravity of the present economic situation, and an attempt should be made to confer regarding the foodstuffs question with a view to strengthening the position of the West Indian colonies as a whole. Trinidad, for example, ought to be able to obtain most of her meat supply from British Guiana and St. Vincent and not from Venezuela as she does at present; or better still, Trinidad might raise more live stock locally, especially in view of the fact that the manure produced would be of great value on the cacao estates which at present are not in most cases adequately fertilized.

First Year's Work of the Ceylon School of Tropical Agriculture.

Interest attaches to the report on the first year's work of the School of Tropical Agriculture, Ceylon, which appears in the *Tropical Agriculturist* for January 1917.

It will be remembered that the School was opened in January 1916. A Final Examination was held during December 1916, and it is to this that the reports of the Registrar and Examiners refer.

The Final Examinations comprised fourteen written papers and three practical examinations, one each in Plant Diseases, Planting, and Horticulture. Of the fourteen papers, there were seven major papers, requiring a higher percentage of pass marks, than the seven minor papers. Major papers were set in Botany, Economic Products (2), Soil, Accounts, Planting and Horticulture; minor papers in Chemistry, the Animal, Agricultural Engineering, Plant Diseases, Crop Pests, Co-operation and Manures.

Fifty-six students sat for the examination: seven obtained a first class with 60 per cent. marks and over twenty-one a second class, with a percentage of between 50 and 60; and thirteen others satisfied the examiners.

It is stated that the results showed few surprises, the passes almost being exclusively limited to the steady workers.

The report of the Examiners published in the journal referred to above, indicate that the students showed a tendency in the direction of 'cramming', and some of the answers lacked conciseness. It would appear that the practical examinations revealed only a moderately familiar acquaintance with the various operations.

It would be interesting if some of the questions set were published in order that some idea of the standard required by the Examiners could be obtained.

Year-Book of the Ceylon Agricultural Society, 1917-18.

It is hoped, in the Introduction to this attractive looking volume, that it will 'furnish members with all such information as they are likely to need in their everyday life as "tillers of the earth".' Perusal of the subject-matter, however, does not enable us to see how this hope is likely to be fulfilled. For instance, the planting notes, which occupy some forty pages, deal almost exclusively with garden vegetables and fruit trees; references to the staple cultivations of the colony—coconuts, tea, rubber and cacao are almost entirely omitted. The section on Pests and Diseases also seems to be unsatisfactory, particularly the notes dealing with pests, inasmuch as practically no reference is made to specific pests that give rise to trouble in Ceylon.

Some of the statistics and tables will be found useful in a general way, and the information concerning the various agricultural institutions in Ceylon will be found useful for reference not only in Ceylon but also in other parts of the tropics. One or two miscellaneous sections, for example, those dealing with dry-farming and shade trees, are good, but as we have already implied, much more might have been done to make this Year-Book of greater interest and value to the planter and business man. It should have been possible to incorporate briefly the results of investigations by the Departments of Agriculture in Ceylon and other colonies where similar conditions prevail—the results of manurial experiments with cacao and coco-nuts, experiments in regard to the tapping and vulcanization of rubber, varieties and the selection of seed, etc. A short review of the market prices for the principal products during the past year would have been an interesting feature.

The volume contains a section embodying veterinary notes: but speaking generally, the volume is more in the nature of a Year-Book of a Horticultural than of an Agricultural Society, as we understood the two terms in the West Indies.



INSECT NOTES.

THE SPREAD OF THE PINK BOLL WORM.

In the current number of the *Journal of Economic Entomology* there is a notice to the effect that last November specimens of cotton bolls showing the presence of *Gelechia gossypiella* were received at the Bureau of Entomology in Washington from San Pedro de las Colonias, Mexico. This is the first time that this important pest has been recorded from America, and investigations indicate that it was introduced into Mexico in cotton seed imported from Egypt for experimental purposes. In order to safeguard the country against further danger from the pink boll worm an absolute quarantine was immediately placed on Mexican cotton seed and bales of lint. Further, all shipments of Mexican cotton seed which have entered the United States since last July have been traced to their destinations and steps are being taken to have this seed crushed without delay. It is fortunate, however, that most of this imported seed was more than a year old and would therefore be free from infestation. This pest has probably been established in the Lagune District of Mexico for two or three years, but has apparently only spread extensively during the last year, and so far it has not been discovered in any of the seed brought into Texas.

It will be seen from this that the cotton crop of the Southern States is threatened with a very serious danger, and unless the pink boll worm can be exterminated by co-operative work between the United States and Mexican authorities, its ultimate infestation of the cotton fields of the Southern States is a practical certainty.

This insect has been mentioned in former numbers of the *Agricultural News*, and an account of its life-history, habits, etc., was given in Vol. XIV, No. 346, so that it is not proposed to go into these in detail again, but it may be of interest to recall the distribution of this pest and the way in which it has spread.

A little more than ten years ago (1906) the pink boll worm was known only in the cotton-growing countries of Asia, but three years later (1909) it had spread to East Africa, and by 1914 it was recorded from India, Ceylon, Burmah, Straits Settlements, Egypt, British and German East Africa, Nigeria, Sierra Leone and the Hawaiian Islands. At the present time it is probable that this insect extends throughout the cotton-growing countries of Asia and Africa, and has lately become established in a district of Mexico.

HOW THE PEST SPREADS.

The larvae, that is the pink boll worms themselves, besides attacking the unripe cotton seed in the growing boll, are also found in seed in old dried bolls, in seed shipped for planting or oil extraction, and even in the seed which gets into baled cotton. The duration of the larval stage is usually about three weeks, but records show that this can be prolonged to such an extent that it would be possible for the larvae to survive even the most distant journeys. The

pupal stage is often passed inside the shell of the seed which has been excavated by the larva, so that the period of spread is still further lengthened.

The pink boll worm has on several occasions been intercepted in shipments of cotton seed in the United States and up to the present time it has not become established in that country. The following instances taken from the *Journal of Economic Entomology* will show that there is a constant danger of its entering a new country under unusual conditions.

On one occasion some 'dead larvae of *Gelechia gossypiella* were found in samples of China cotton enclosed in glass trays exhibited at the Panama-Pacific Exposition at San Francisco. Although every precaution was taken to safeguard this material by the California authorities, the finding of these dead larvae forcibly demonstrates the possibility of introducing new and injurious pests in plant products exhibited at Expositions.

'In this connexion it is of peculiar interest to note that the prize ship *Appam* which was brought into Hampton Roads (Virginia) early in the year (1916), contained as a part of its cargo some 200 tons of cotton seed from Lagos, West Africa, a region known to harbor the pink boll worm. Although no living larvae of the pink boll worm were located, it was apparent from the condition of the material that about 2 per cent. of the seed had at one time been infested with this insect.' It is further stated that as a precautionary measure the entire shipment of cotton seed was converted into fertilizer, and the dock on which the seed had been unloaded was thoroughly cleaned and the ship fumigated with hydrocyanic acid gas.

Now that the pink boll worm has gained an entrance into Mexico, it would seem that the strictest quarantine measures and the most rigid inspection will be necessary in order to prevent the spread of this pest to the cotton district of the Americas and the West Indies. Until the processes for treating cotton seed (mentioned below) have been perfected, and until these or similar measures of control have been generally adopted in the countries infested with this pest, it is strongly urged, as has been suggested in a former number of the *Agricultural News*, that a prohibition be placed on the importation of all cotton-seed from infested countries into those West Indian islands where a cotton industry exists. This would not be such a hardship as might at first appear, since the various cotton-growing islands in the West Indies have well-developed strains of fine cotton, and the importation of seed for planting is therefore unnecessary. Such cotton seed as may be imported for oil extraction should be admitted only if it comes from a district known to be free from the pink boll worm, and even then under strict regulations.

CONTROL WORK AGAINST THE PINK BOLL WORM IN EGYPT.

For the last four or five years since the pink boll worm began to be a serious pest in Egypt, experiments have been in progress to find out some means of controlling the insect not only in the growing cotton, but also in the picked cotton seed, and in the old dried up bolls left on the cotton sticks after the crop and subsequently stacked for fuel. These measures of control are all more or less in the experimental stage, but it may be of interest to refer to the more important of those that have been mentioned in the *Agricultural Journal of Egypt* from time to time.

The recent work of the Government Experimental Farm has shown that the damage done to the growing bolls by this insect can be materially lessened by an earlier

planting and gathering of the crop. This method of control may not turn out to be practicable on a large scale, but it has possibilities.

The experiments against *Gelechia gossypiella* in the mature cotton seed fall under two main divisions: mechanical methods and chemical methods. Under the first we have the application of heat or cold and the treating of the seed in a vacuum; and of these the hot air treatment of the cotton seed has been found to be the most effective. One of the machines consists mainly of a furnace for the generation of the hot air, a hot air chamber through which the seed passes in trays on four endless bands made of iron chains, and a motor.

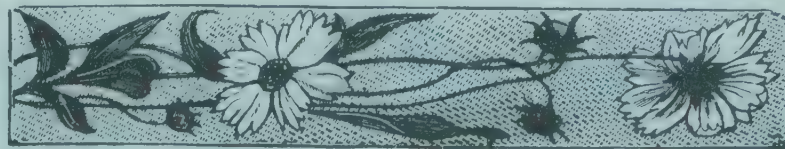
In working the machine there are four factors to be considered: (1) the temperature of the seed when entering the machine; (2) the time required to pass through the machine; (3) the temperature the machine is regulated to give; and (4) the temperature of the seed at the exit. Of these four factors the last is the most important, and the other three must be regulated so as to keep the temperature of the seed at the exit between 119° F. and 131° F., the best temperature to maintain being 122° F. This treatment seems to be effective against the larvae without damaging the seed. Another machine designed for drying malt has been adapted for the hot air treatment of cotton seed, and has given excellent results.*

Under the chemical methods of control we get the fumigation of the cotton seed with carbon bisulphide, or with hydrocyanic acid gas. Both of these chemicals have proved satisfactory, but hydrocyanic acid gas seems to be the favourite, since, although it takes longer to act, the danger of explosions is eliminated, while carbon bisulphide is highly inflammable. The treated seed can still be used in the preparation of seed cake or in the extraction of oil, since the quantity of hydrocyanic acid found in the cake prepared from treated seed is so small that it would in no way prevent its use as cattle food, while no hydrocyanic acid could be detected in the partly refined oil.

It has been remarked in an article in the *Agricultural Journal of Egypt* that the treatment of the seed as mentioned above 'would be futile unless rigorous measures are adopted to destroy all cotton bolls left on the cotton sticks after the last picking.' With the object, therefore, of destroying the pink boll worms infesting the dried bolls left on the cotton sticks at the end of the season some experiments have been carried out to convert the cotton sticks, as soon as they are removed from the fields, into charcoal. It has been found that the charcoal made from the cotton sticks will fetch a price which will more than cover the expense incurred in converting the cotton wood into charcoal.

The control measures mentioned above in connexion with the pink boll worm are also to a less extent useful in checking some of the other cotton pests in Egypt.

A copy of the *Annual Trade Review*, being a special supplement to the *Chamber of Commerce Journal*, the official organ of the London Chamber of Commerce, has been received, reviewing the trade of the United Kingdom for 1916. For purposes of comparison the pre-war year 1913 is taken, and it is shown that the trade of the United Kingdom has been maintained at an extraordinarily high level, considering the enormous difficulties in labour and shipping, and various restrictions that have had to be faced. The sections of the review, which should be studied by all West Indian merchants and planters, that are of more especial interest in the tropics, are those devoted to the trade of London and Liverpool, which include references to tropical produce.



COTTON IN UGANDA.

It is pointed out in the Annual Report of the Department of Agriculture, Uganda, for 1915-16, that the cotton crop is the most important agricultural and economic product of the Protectorate, and there appears every likelihood that its position in this respect will be maintained. An estimated capital value of £4,000,000 has been placed upon the cotton industry, which has been carefully built up and fostered by the Government.

Buying and ginning are done entirely by traders, however. This accounts to a large extent for the serious temporary set-back the industry received the previous year, when cotton was practically unsaleable for over six months. The effect of military operations seriously interfered with transportation to the coast, while shipping difficulties also led to large quantities of lint being held up.

Provision is made in Uganda for seed distribution, and during the season of 1916 seed sufficient to plant 100,000 acres was distributed.

Uganda cotton is of a high standard when marketed in good clean condition, and an average price of 120 to 130 points on middling American can be confidently expected, while some consignments realized 150 points on, with occasionally better prices for odd lots.

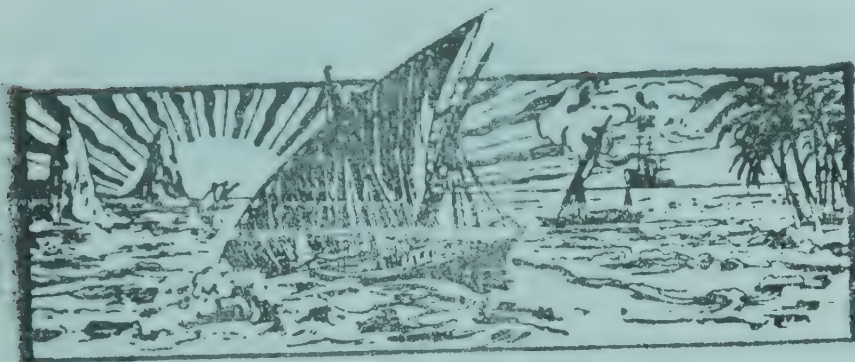
As regards ginning percentages, the percentage of lint to cotton seed is stated to vary from season to season, and in different localities. Three ginneries to the eastern Province gave figures of 28.08 per cent., 29.18 per cent., and 30.36 per cent., while another factory which handled over 1,000,000 lb. of seed-cotton had an average ginning percentage of 31.36 per cent. As regards spinning results, the Fine Spinners' and Doublers' Association of Manchester reported that the cotton was 'very inferior to ordinary Egyptian, but that it compared favourably with extra stapled American.

Surplus cotton seed has a special use in Uganda. In 1915-16 only 5,225 tons of cotton seed were exported, compared with 9,017 tons last year. The seed consumed locally is used largely for fuel in generating steam power, and as the residue is rich in potash, planters have at their disposal a valuable manure for all crops.

It is stated that a certain amount of oil was expressed locally, and exported. In many of the cotton ginneries, the seed is entirely used for generating suction gas, and the production of power is thus very economical.

Coffee in Uganda.—Whereas cotton cultivation is the principal native cultivation in Uganda, coffee maintains its position as the principal European crop; but it is to some extent a favourite exportable crop grown by natives. The rapid progress of the industry is shown in the Annual Report of the Department of Agriculture for 1915-16, where it is stated that the value of the exports was only £383 in 1910-11, while last year the value was £87,202. Pests have been much in evidence, however, on coffee plantations, though the disease caused by *Hemileia vastatrix* does not appear to have been much in evidence. Coffee, on the whole, seems to be proving to be a risky crop. In the more humid parts of the Protectorate, the more disease-resisting species, *Coffea robusta*, is being grown, the drier and more elevated parts being allotted to Arabian coffee.

* *Rev. App. Ent.*, IV, Ser. A, pp. 472-91.



GLEANINGS.

Observations relating to staple crops in St. Vincent show that during March good progress had been made with the reaping of the arrowroot crop. During that month old cotton stalks had for the most part been destroyed. Sugar and syrup manufacture were in full swing.

According to *The Board of Trade Journal*, the sugar industry in Guatemala has developed in recent years, particularly since the war. The past season is stated to have been a very prosperous one for cultivation, and there are indications that the industry will assume still larger proportions in the near future.

Growing Long-staple American Cotton by Irrigation is the subject of an article in the *India Rubber World* for March 1. The area where this takes place is known as the Imperial Valley, California. Government crop reports show that the yield is high and that the staple has good length, strength, and uniformity. The average yield per acre is from 400 to 500 lb., whereas the average cotton yield in the entire country is stated to be 170 lb.

It is stated in *Colonial Reports*—Annual, No. 910, that there is room for considerable development of the fisheries of British Guiana in several directions, especially in sea-fishing, and curing with the aid of ice and smoking. A fair supply of sea-fish is generally kept at the ice depôt, but ice is not generally used. As in other colonies, salt fish are imported in quantity, but no attempt is made to cure the local fish. Fresh-water fish is obtainable in the markets but not to the extent desired.

According to the London correspondent of the *North Queensland Register*, sweet potatoes have everywhere in Queensland been found satisfactory food for pigs. Queensland farmers consider the sweet potato as pre-eminent—the best root crop for hogs for autumn grazing. By means of a combination of sweet potatoes, peanuts and cow-peas, the most profitable hogs may be produced. Generally, in feeding peanuts, it is the custom to add a small amount of corn in order to balance the rations.

According to advices from Mr. W. N. Sands, Indian corn purchased last year at the Government ginnery, St. Vincent, on the profit-sharing basis, was put on sale in the form of meal for human consumption last month. The supply—620 cwt.—was far below the quantity that could have been disposed of during the next four months owing to the high prices of imported foodstuffs. The successful working of the corn drier, and the storage in perfect condition of a large quantity of corn should stimulate the planting of this crop during the coming season.

An instructive paper was read before the Colonial Section of the Royal Society of Arts on January 30 last, by Mr. Octavius C. Beale, representative and past President of the Australian Associated Chambers of Manufacture, on Imperial Industries after the War. Reference was made at some length to the sugar situation, and it was pointed out that the British Empire is well able to produce the sugar it requires. Mention was made of the mutual benefit derived by Canada and the West Indies in regard to trade, particularly sugar and flour.

The Punjab Government has sanctioned the registration of a co-operative credit society in connexion with the North Western Railway, possessing unique features. It is stated in the *Wealth of India* for January 1917, that this Society will differ from the ordinary co-operative credit society in three essential points. First, its committee of management will not be wholly elected by the members of the society, but will be partly *ex officio*; second, voting by proxy will be allowed, owing to the fact that members will be scattered all over the line; third, the Raiffeisen principle that no loan should be only for productive or provident purposes cannot be strictly adhered to.

The cattle-raising potentialities of British Guiana are referred to in *Colonial Reports*—Annual, No. 910. It is stated that there are large areas of land suitable for this purpose. The number of cattle in the Colony is estimated at 100,300, but it is thought certain that this estimate is far below the actual figure. Cattle raising was continued on the Rupununi and Takatu Savannahs, and at December 31, 1915, there were in existence for these localities twelve commissions held by eleven different ranchers, embracing an estimated area of 591½ square miles. The number of cattle on these ranches is estimated at not less than 12,500 head.

A forecast of the Indian indigo crop, 1916-17, appears in *The Board of Trade Journal* for February 8. The total area, 736,400 acres, is 114 per cent. in excess of the finally revised area of 353,100 acres of 1915-16. All the Provinces show an increase in the area sown, the largest increases being in the United Provinces and in the Punjab. The total yield of dye is estimated at 95,500 cwt. as against 55,100 cwt., the finally revised estimate of 1915-16, or an increase of 73 per cent. The season has not, on the whole, been favourable for the crop except in the Punjab, Bombay, and Sind. Heavy rainfall and floods adversely affected the crop in the United Provinces and in parts of Behar, Orissa and Madras.

Nature for February 22 last, publishes the following note on the recent report on the Agricultural Department, St. Vincent: 'In addition to the usual work, experiments on cotton breeding are being made at the Experiment Station, which, if they can be fully carried out, should yield valuable results. Plants possessing resistance to angular spot and boll rot have been selected, and an effort is being made to breed from them resistant strains. Selection for lint characters is also being undertaken. Should varieties be produced capable of resisting the attacks of the cotton stainer—the main cause of boll trouble—the cotton yield would be nearly double. Work of this kind emphasizes the great need for the establishment of properly equipped agricultural research stations in the tropics in order that plant-breeding experiments needing many years of careful research may be undertaken without interruption and hindrance.'



MANURIAL EXPERIMENTS WITH ARROWROOT IN ST. VINCENT.

A paper on this subject, by Mr. S. C. Harland, B.Sc., Assistant Agricultural Superintendent, St. Vincent, containing the results of experiments recently carried out by him, has been forwarded to this Office for publication. The paper will appear in full in the *West Indian Bulletin*, but the results are of sufficient immediate interest to make it desirable to publish a brief summary here.

It is pointed out first that arrowroot is the chief staple crop in St. Vincent, and that while manurial experiments with this crop have been conducted in previous seasons, the results have hitherto not been conclusive. It was therefore determined to plan an experiment in such a way as would yield definite results, and the principle adopted on account of land limitations was to employ a large number of small plots rather than a small number of large plots.

The experiments were conducted with two objects: (1) to test the value of mulching with prunings of *Gliricidia maculata* (Madre del cacao); (2) to compare the relative values of various combinations of organic and artificial manures. In the first experiment the number of plots was twelve, of which four were mulched and eight were left unmulched. Each plot was $\frac{1}{138}$ -acre in area, and each mulched plot received an application of 40 lb. *Gliricidia* prunings. The average yield of unmanured plots was 9,565 lb. per acre, while the average yield of the mulched plots was 15,663 lb. per acre. This shows a gain by mulching of 6,098 lb. per acre or 63.8 per cent. This increase from mulching is very striking, and it may be mentioned that the probable error test shows that the gain is quite significant.

In the second experiment nine different combinations of manures were applied to thirty-six plots, each combination being in quadruplicate. The average of the manured plot indicates that with the exception of the nitrogen plot, every plot shows a gain over the unmanured plots of more than twice the probable error, and this increase is such that it can be due only to the fertilizers applied. The plot to which *Gliricidia* prunings were applied shows a gain of 34 per cent. over the unmanured plots. A complete manure consisting of sulphate of potash, bauxite slag, and cotton-seed meal produced the next largest increase, namely, 19 per cent.

The results, as a whole, clearly indicate that the arrowroot grower will at any rate be well advised to apply to the soil as much coarse organic material as possible, and it is hoped that planters will give this matter their early consideration.

AGRICULTURAL INSTRUCTION WORK IN GRENADA.

This Office has been furnished by His Excellency the Governor of the Windward Islands, with the reports of the Agricultural Instructors, Grenada, for March 1917.

Mr. W. M. Malins-Smith's report indicates that considerable amount of country visiting was done. Peasants' holdings

were inspected in the parishes of St. David's, St. Andrew's and St. Patrick's. A good deal of Prize-holdings competition work was effected in these parishes, many entries in the provision garden section being obtained. The land settlements of Morne Rouge, Westerhall and St. Cyr Mountain were visited and settlement work performed. The experiment plots on the Settlements were inspected, and the work thereon supervised. Several estates were visited during the month. In regard to the Prize-holdings competition, it is stated that more than sixty entries were obtained in the Provision Garden Competition, and all intending competitors were given advice and instruction. Routine work was continued during the month at the Experiment Plots, and the yield of cotton, corn and pigeon peas appears to have been satisfactory. Regarding diseases and pests the thrips trouble received attention.

Work was done during the month in connexion with forest preservation. The mountain ridges in the northern mountain districts of the island were inspected in connexion with the control and preservation of the forests. It appears desirable that control should be exercised over the clearing of these ridges at elevations over 1,500 feet in order to render secure the conservation of moisture.

It is stated that the Morne Rouge sugar factory started its season's operations on the same basis as during 1916. The crop of the settlers appeared to be much the same as that of last year.

Mr. Donovan's report signifies the continuance of similar activities in other parts of the island. Concerning instruction work, efficient drainage and proper cultural methods were again emphasized.

NATIVE FLOUR IN GRENADA.

The cultivation of ground provisions on as extensive a scale as possible was recommended and advice given as to the preparation of flour from breadfruit, bananas and sweet potatoes. In this connexion it is stated that the advice as to the preparation and use of native-made flour has not been followed by the peasantry to any extent whatever. Some of the peasants maintain that the lack of surplus provisions at this season of the year operates against their making native flour, while others maintain that times are so hard that they cannot think of converting provisions into flour, since these articles are at present cooked and eaten before they are even in a mature condition. Mr. Donovan goes on to state that two large proprietors said they regarded the making of native flour as an excellent idea, but that the average peasant had no surplus of provisions for this purpose. The larger estates were the only places where bananas and breadfruit were grown in abundance, and they found a ready sale for these articles. It would appear that the supply of provisions in Grenada never exceeds the demand for consumption as such, and before the peasantry take to making flour or meal there must be a considerably greater production.

In this connexion Mr. J. C. Moore, Superintendent of Agriculture, observes: 'Although the quantity of ground provisions produced in Grenada during the past year has considerably exceeded the output of former years, there is at present no surplus available for converting into meal for future use because more provisions are being consumed in place of imported foods. This condition operates in maintaining the high prices of provisions which continue to show an upward rather than a downward tendency, a result which might not at first sight have been expected as the outcome of increased production.'



PLANT DISEASES.

A SURVEY OF THE YEAR 1916.

Reports on the prevalence of plant diseases have now come in from the Agricultural Officers in the chain of islands from Tortola to Grenada, and may usefully be compared and summarized here. They will eventually be printed in full as usual in the *West Indian Bulletin*.

CLIMATE. Climate, of which the effective variable components in this region are rainfall and wind, is ever more clearly seen to be the chief determining factor in the incidence of the established diseases. Given the rainfall and its distribution through the year, one might now with fair accuracy deduce the extent of their occurrence under the particular conditions of each island.

During the year under review the rainfall on the whole reached a good standard without being excessive, but abnormally heavy rains were general in October and November. In some of the islands, particularly in St. Vincent, there was something like a deluge in that period.

Heavy winds were experienced in August, September and October, associated with numerous cyclonic disturbances. A section of Dominica on August 28, and the Virgin Islands on October 9, were devastated by hurricanes.

SUGAR-CANE. The only disease of sugar-cane now occurring to any significant extent to these islands is the root disease caused by *Marasmius sacchari*. The distribution through the year of a sufficient supply of water to maintain fairly regular growth led to a general freedom from this disease. It may be gathered from the reports that in this respect both 1915 and 1916 have been favourable much beyond the average. Some instances of local damage are reported from most of the islands, which may be safely assumed from previous experience to be due in most cases to poverty of soil or insufficient cultivation. In Antigua there is a probability that some of the trouble arose from the water-logging of very stiff soils.

COTTON. The cotton crop is extremely sensitive to irregularities in the weather. The planting season adopted has been determined with reference to the normal expectation of a period of good growing weather, in which the plant builds up its leaf and branch system, followed by a drier period in which the bolls may mature without hindrance from diseases. The only complaint with regard to the first period refers to the effect of a dry June on the development of the plants on the windward side of Montserrat. The early planting which exposed the plants to this, later enabled the cotton in that district to escape the worst effects of the unseasonable rains in October and November. Heavy losses from this cause were experienced in the remaining cotton-growing areas, amounting in St. Vincent to little short of disaster. So far as could be ascertained the greatest part of the damage during the actual wet period was due to the soft rot fungus (*Phytophthora*) which is very rapid and destructive in its action. This is definitely known to have been the case in St. Vincent and Montserrat. The disease is dependent on very moist conditions and in normal years is largely confined to low growing, heavily screened bolls. In the year

under notice the writer found in St. Vincent that its spread had been very largely arrested after about a week of fine weather had succeeded the rainy period before mentioned.

The bacterial boll disease was also generally prevalent during the wet weather and so far as could be made out always preceded the formation of the sunken spots infested with a pink *Colletotrichum* which have been generally accepted as evidence of the prevalence of anthracnose.

The drier weather of the second half of November and of December permitted of some recovery in the returns from the latter end of the crop, and these are noted in St. Kitts as being larger than was expected. In St. Vincent any compensation of this kind was prevented by the prevalence of the internal boll disease, which became quite general with the large accumulation of cotton stainers usual at the end of the season. This type of loss occurs in the other islands to some extent and has been on occasion severe, notably in Montserrat, but it is not yet clear why its effects should be so generally serious in St. Vincent, while in St. Kitts, for example, they are in comparison hardly felt.

With regard to the year 1916 it may be said in general that the early planted cotton came off by far the best.

CACAO. The year was a generally favourable one for the cacao crop.

From St. Lucia there is a report of the prevalence of fungoid disease having been increased as a result of over-abundant rainfall. Pod rot and canker are generally distributed to the cacao-growing islands, but do not with the exception noted appear to have occurred to an unusual extent. The Rosellinia root disease is too gradual in its spread to show any considerable fluctuation from year to year.

As in the case of sugar-cane root disease, to which it is in its nature similar, the *Diplodia* die-back of cacao trees is not much in evidence in a year of sufficient rainfall, and some affected areas show considerable improvement as a result of favourable weather in this and the preceding year.

LIMES. From Dominica it is reported that in the majority of cases steps are being taken to combat *Rosellinia* disease in the plantations affected. The red root disease has been found in a district where it was not previously known, the circumstances of its occurrence being such as to emphasize the indications which already existed that insufficient drainage is an important predisposing cause.

The only disease of mature trees reported from St. Lucia is a form of gummosis and collar rot associated with poorly drained land. The prevalence of wet and cloudy weather caused heavy losses of seedlings by damping-off, and similar trouble was experienced at times in Grenada and Montserrat. In Dominica it was found possible to keep the disease in control by prompt and repeated applications of the usual mixture of sulphur and lime.

In Montserrat the dry weather of the month of June, coming when the trees were maturing a heavy crop, caused the fruit to be small and gave the trees a severe set-back. The generally ample rainfall of the years 1915 and 1916 has not arrested the progress of die-back in a declining field kept under close observation.

With regard to miscellaneous crops there are few reports of special trouble. Maize gave poor returns in St. Kitts, due in one case noted to an undefined root disease. The leaf-rust of ground nuts in Montserrat was more severe than usual, and not so well controlled by Bordeaux mixture. In the same island onions planted in September and October were a partial failure, a result which is not attributed to disease but to the direct effects of unsuitable distribution of the rainfall.

CURING VANILLA BEANS.

The following note appears in the *Perfumery and Essential Oil Record* for February 22, 1917:—

Rabak (*Journ. Ind. and Eng. Chem.*) says that two general methods of curing vanilla are in vogue, the dry and the hot water methods. Experiments were conducted by him with twelve lots of beans, half of which were cured at room temperature, and the other half in a water-oven at somewhat higher temperature. Each of the six lots cured at room temperature was given different treatment prior to the sweating and drying. The treatment consisted in dipping the green beans into water at various temperatures up to the boiling point. Each lot was kept wrapped in a soft towel and placed on the laboratory shelf to undergo the sweating and drying process. The duplicate lots of beans cured in the water-oven at 40-55°C. received exactly the same treatment as those cured at room temperature. The results show that the curing process as at present commercially applied is unnecessarily long and extended, requiring on an average several months for the transformation of the green to the cured beans.

The beans can be cured in a much shorter time by means of a much less tedious process. It has further been demonstrated that the process is simplified to the advantage rather than to the detriment of the aromatic constituents. While the amount of vanillin in the beans was not increased appreciably, as compared with that in commercial beans, the beans cured in the laboratory were in most cases superior in vanilla resins and colouring matter. A considerable proportion of the vanilla resins are left unextracted when the menstruum is less than 65 per cent. alcoholic strength. Curing the green beans at room temperature either without previous treatment or after treatment with water up to 90°C. for a short period of time apparently produces beans of the best quality, as judged by the flavouring extract prepared from the samples.

The Gassing of Plants.—The cactus pest, called 'prickly pear', which has caused loss in Queensland, is now being successfully combated. The method in operation in the Queensland experimental areas is entirely novel. It consists of 'gassing', as well as of spraying with arsenic trichloride. After many months' experiments the treatment of certain species of pear with arsenic trichloride in a gaseous form has been proved to be effective, while the problem of manufacturing the trichloride in large quantities has also been successfully settled. Trichloride is now obtainable in large quantities at a cost of £22 per ton.

The place selected in Queensland for the experimental work was Delacca. This district contained some of the worst pear growth in Queensland, ranging from 7 feet to 8 feet high, and of such dense impenetrable growth as to make spraying impossible. Areas that had been gassed some twelve months ago, are entirely free from pear, both bulbs and leaves having been destroyed right out. The gas is applied by means of an atomiser, the machine charged weighing about 12 lb. The cost of the machine is £6, and it is claimed that one man at 10s. per day can cover 3 acres of heavily scattered pear in eight hours. Wherever the gas goes the pear becomes discoloured and brown, and all flowering and fruiting is instantly checked. Gassing can be applied with the best results after heavy dews or rainfall. The trichloride apparently has no effect upon other vegetation, because of their lower water contents. Neither is there any danger in regard to stock, since cows eat affected pear.

EUCALYPTS IN THE FEDERATED MALAY STATES.

Great success has attended the planting of certain species of Eucalyptus in parts of the Leeward Islands, and it will perhaps interest residents there to know of the results obtained with these valuable and attractive trees under the humid conditions of the Federated Malay States. In the *Agricultural Bulletin, F.M.S.*, for November 1916, data as to the growth attained are given, and the article goes on to say:—

It will be seen from the preceding tables that the greatest success has been obtained with the Red Gum (*E. rostrata*). This species so far appears to be amenable to the climate of the plains of the country. The Lemon-scented Gum (*E. citriodora*) also is growing well. The Blue Gum (*E. globulus*), however, has not grown well, and there is little doubt that this species is unsuited for this climate. It has been unnecessary to give much attention to these seedling Eucalypts beyond keeping them well staked, as they are liable to be broken by the wind during the early stages of their growth.

The writer is of the opinion that certain species of Eucalyptus might successfully be grown on the hills of this country. It is intended to have a representative collection of those species which have been raised from seed this year, planted out at various altitudes at the Experimental Plantation, Gunong Angsi, Negri Sembilan.

It is interesting to note that two Eucalyptus thought to be *E. citriodora*, raised from seed in the Experimental Plantation, Kuala Lumpur, in 1914, have attained a height of 40 feet, and a girth of 14 inches at 6 feet from the ground. These two trees are growing in the original seed beds, and have made rapid growth, and at the present time look very healthy. It is unfortunate that some uncertainty exists as to the correct nomenclature of these two trees; should they flower, it would probably be possible to identify them.

In conclusion, the writer would emphasize that not only is there a great difficulty experienced in raising Eucalyptus from seed, at any rate on the plains in this country, but also that the humid atmosphere would probably be unsuited for most species, as the behaviour of the trees in Singapore Gardens indicate. Whether more favourable results will attend the present experiments remains to be seen.

CHANGING SCIENTIFIC NAMES.

In regard to the article (p. 119) on 'Some Fruits Grown at Bahia', reproduced from a recently issued Bulletin of the United States Department of Agriculture, it will be noticed that new scientific names for certain trees are used in the place of those ordinarily accepted as correct. The tendency in the United States to change scientific names in all branches of biology is gradually making American biologists unintelligible to those of other countries. Some changes are unavoidable, but when they are made for trivial reasons, or for effect, it not only leads to confusion in scientific studies, but also reflects adversely upon the reputations of those who are responsible for such changes.

DEPARTMENT NEWS.

Mr. A. E. Collens, F.C.S., Assistant Analyst, Trinidad Department of Agriculture, has assumed the duties of Acting Government Chemist and Superintendent of Agriculture for the Leeward Islands. When passing through Barbados en route for Antigua, Mr. Collens spent some time at the Office of the Imperial Department of Agriculture.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
February 22, 1917.

ARROWROOT—5½d.
BALATA—Block, ¾ to ¾; Sheet, 3, 8 to 3/10.
BEESWAX—No quotations.
CACAO—Trinidad, 79/-; Grenada, 70/- to 75/-; Jamaica, 70/6 to 74/-.
COFFEE—Jamaica, no quotations.
COPRA—£46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £17 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, 85/- to 105/-.
ISINGLASS—No quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—4½d. to 5d.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., March
28, 1917.

CACAO—Caracas, 12½c. to 13c.; Grenada, 13c. to 12½c.; Trinidad, 12½c. to 12½c.; Jamaica, 10½c. to 10½c.; COCO-NUTS—Jamaica and Trinidad selects, \$41.00 to \$42.00; culls, \$27.00 to \$28.00.
COFFEE—Jamaica, 9½c. to 9½c. per lb.
GINGER—16½c. to 16½c. per lb.
GOAT SKINS—Jamaica, \$1.15; to \$1.20; Antigua and Barbados, \$1.10 to \$1.15; St. Thomas and St. Kitts, \$1.00 to \$1.10 per lb.
GRAPE FRUIT—Jamaica, 75c. to \$1.75.
LIMES—\$5.50 to \$6.50.
MACE—37c. to 42c. per lb.
NUTMEGS—22c.
ORANGES—\$1.50 to \$2.00.
PIMENTO—5½c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 5.77c; Muscovados, 89°, 5.21c.; Molasses, 89°, 4.77c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., February 23,
1917.

CACAO—Venezuelan, \$14.00 to \$14.25; Trinidad, \$17.28 to \$17.76.
COCO-NUT OIL—\$1.45 per Imperial gallon.
COFFEE—Venezuelan, 12½c. to 14½c.
COPRA—\$7.25 per 100 lb.
DHAL—No quotations
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$8.40 to \$8.75; White, \$9.25 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GABRAWAY & Co., March 20,
1917.

ARROWROOT—\$5.00 per 100 lb.
CACAO—\$11.50 to \$12.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, \$112.00 per ton.
MOLASSES—No quotations.
ONIONS—\$4.50.
PEAS, SPLIT—\$10.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$8.55; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$4.50.

British Guiana.—Messrs. WIETING & RICHTER; Messrs.
SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



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Resistance to Disease.

IT is becoming more and more evident as tropical agriculture develops in extent and complexity that we must take wider views than in the past regarding the maintenance of health in plants and animals. It is becoming necessary to investigate more deeply the relationships that exist between parasites and their hosts, and to study more closely the influence of conditions of environment.

The avenues of enquiry followed in the past have not led very far towards great discoveries. When it has become necessary to investigate a new plant disease or infestation, the first line of attack has generally been to find a causative parasite, then to study its life-history, and ultimately to name it. After that it has been customary to suggest various expedients—legislation, various forms of mechanical treatment like spraying, and

sometimes modification in cultivation practices. Generally speaking the tendency has been to concentrate on the parasite rather than on the host, and to neglect the factors governing the relationship between the two. It is owing to this that economic entomology and to a less extent mycology have failed, in many instances, to appeal to the practical planter. The planter naturally thinks first of the host, and it very often happens that this instinct has a great deal to justify it scientifically.

To get below the surface we must ask ourselves *why* an individual is diseased or infested. Observations, however minute regarding the fact that it *is*, are not sufficient to afford fundamental assistance in prevention. Something more is required than diagnosis and the application of expedients.

The prevalence of disease is intimately associated with what we term 'resistance'. A plant may be resistant to a disease constitutionally, or on account of external conditions increasing the plant's vigour. Conversely it may be susceptible constitutionally or because external conditions are inimical. Similarly the intensity of parasitism by an organism attacking it may be chiefly constitutional or largely the effect of external conditions upon the organism. Thus disease will be most prevalent amongst constitutionally susceptible individuals growing under conditions unfavourable to these individuals but favourable to a particular parasite. This implies, of course, the presence of infection in the first place.

These considerations lead us to group plant diseases in the West Indies under two great classes: diseases which are due to the existence of conditions unfavourable to the host; and diseases which are due to conditions favouring the fungus. An example of the first group is the root disease of the sugar-cane. Constitutionally

the sugar-cane is neither especially resistant nor susceptible to root disease; but unfavourable conditions, as for instance, water-logging or drought so weaken the plant that it becomes susceptible owing to external influences. In the case of root disease, also, it is to be noted that the fungus is not an obligate parasite and can in fact live as a saprophyte. Hence root disease of the sugar-cane is essentially a 'conditional' malady.

As examples of the second group, we may take 'canker' of cacao, the Rosellinia root disease and the disease of seedlings known as 'damping off'. Such diseases as these are prevalent when conditions favour the fungus, even though the conditions may be favourable to the health of the hosts. The fungus may or may not be an obligate parasite.

As to the exact meaning of resistance—constitutional resistance—we know very little. In plants it may to some extent be mechanical. At any rate resistance increases with age; but only up to a certain point, when it tends to diminish. This looks as if it were concerned to some extent with cellular activity and that constitutional resistance may be due to some chemical property of the protoplasm. In the case of the 'rust' fungi which are strictly parasitic on specific grasses, the resistance of certain strains of host plants has been shown to be due to over-susceptibility. When the leaf is first infected the cells of the surrounding tissue are killed and the parasite then fails to develop on account of its inability to live in dead tissue.

In connexion with resistance to disease, it will be realized that genetics affords an important line of study. Resistance to rust in wheat was transferred by genetic investigations, and it is of interest to record the fact that resistance in cotton to leaf-blister mite has been shown to be hereditary and a definite factor in the gametic constitution of the plant. As to what this factor is we know nothing.

The mention of leaf-blister mite leads us to a consideration of the resistance of plants towards insect pests. Observations seem to indicate that the same principles govern the prevalence of infestations as govern the prevalence of diseases. There is a good deal that is parallel between the prevalence of scale insects and the prevalence of, say, the root disease of the sugar-cane. Both are due to the weakening of the host by unfavourable conditions of environment. A pest like the cotton worm, however, is more analagous to canker of cacao. If conditions favour their development

they will attack their respective hosts without these hosts being in any way weakened by unfavourable conditions of environment.

The discovery of the constitutional nature of resistance to leaf-blister mite lends support to the idea that there may be some organic explanation of resistance to pests as well as to fungi. It may be a question of the production of enzymes or toxins. At any rate it is a subject which deserves the attention of entomologists and workers in bio-chemistry.

In the higher animals we observe the same fundamentals regarding resistance as amongst plants and the lower animals. It is particularly interesting to note the influence of condition in animals on the degree of infestation by such parasites as worms and ticks. A flock of sheep may be equally exposed to infestation yet the thrifty animals will resist the parasites while those in poor condition will be found to be infested. It is not merely that the healthier animals show the effects of infestation less, but that they are actually free or almost free from parasites. There is a good deal that is parallel between this and the infestation of plants by scale insects.

Amongst human beings we notice the same relationship between condition and disease. There is a class of diseases whose prevalence is largely influenced by the effect of conditions on the subject, as for instance pneumonia. On the other hand, a disease like malaria is only prevalent when the conditions favour the development of the parasite and its transmitter. Natural or constitutional resistance also occurs in man as well as in plants and the lower animals. The Jews as a race have been shown to be especially resistant to tuberculosis. This is explained by the fact that for generations Jews have led urban lives and often under conditions favouring infection by tuberculosis. It is thought that in this way the more susceptible individuals have died off with the consequent production of a kind of pure strain in regard to this particular characteristic.

The whole question of the relationship between the host and parasite and the influence of external conditions, is one that should have very much greater attention. From the agricultural standpoint in the West Indies that part of the subject relating to the pests and diseases of plants is of the first importance. A little more original work of this kind in entomology is particularly needed.

THE PLANTS AND ANIMALS OF NEW CALEDONIA.

The principal reason why New Caledonia, the largest island (except New Zealand) in the South Pacific, appeals to the biologist, is because it is exceedingly rich in species, and even in genera which occur in no other part of the world. This is not so in the West Indian islands, where most of the species of plants and animals are exotic. The general features of the island receive attention in the *Geographical Journal* for February 1917, in the form of a paper by R. H. Compton, M.A., of Cambridge, who with Mr. P. D. Montague, spent the whole of 1914 in making zoological and botanical collections, and general geographical investigations in this most interesting French colony.

Economically New Caledonia is renowned for its minerals, being very rich in nickel, chrome, cobalt, and iron. From a scientific point of view, it is the living characteristics of the island which present features of the greatest interest, and these are dealt with at considerable length in the paper under notice.

On the whole, the soil of New Caledonia is not particularly fertile. The cultivation of many different crops has been attempted, but most success has attended the cultivation of coffee and maize. Considerable areas are also under coco-nuts. Nevertheless, the agricultural resources of the country cannot be considered properly developed; the mineral products constitute the most valuable articles of export.

FLORA. The flora of New Caledonia is large and varied, and presents many exceptional features. Not only is it rich in species, but the proportion of endemic forms is exceptionally high. Exact figures are wanting at present, but the endemism extends to numerous genera, and to one group, the Balanopsidae, which is considered by Engler as a distinct Order. The families which contain the highest number of species are the following:—

Rubiaceae 169, Orchidaceae 152, Myrtaceae 142, Euphorbiaceae 120, Apocynaceae 97, Araliaceae 89, Saxifragaceae 88, Leguminosae 79, Gramineae 75, Rutaceae 58, Sapindaceae 53, Sapotaceae 51, Myrsinaceae 47, Proteaceae 44, Cyperaceae 40, Artocarpaceae 37, and Compositae 34.

The most striking feature shown by this list is the position of the Leguminosae, Compositae, and Gramineae. These three families, which are dominant in almost all the local floras of the world, here occupy a very low position on the list. This peculiarity is emphasized by the fact that the great majority of the representatives of these families in New Caledonia are of alien origin, and are indeed plants of economic importance and cosmopolitan weeds of the tropical and sub-tropical zone. For instance, of the seventy-five Gramineae only about half a dozen are native. The majority of the Compositae are plants with easily distributed seeds which have arrived accidentally with imports, and the Leguminosae include a number of culinary and other useful plants. The absence of these families is especially noticeable in the serpentine districts, where the alien flora has made comparatively little inroad; the Compositae, for instance, are represented by a single species, which occurs sparsely at 3,000 feet altitude.

When we consider the large indigenous families, we notice that the main affinities of the flora are twofold. On the one hand, certain families occur in great variety which are of the Indo Malay type; such are the Rubiaceae, Euphorbiaceae, Sapotaceae, and Artocarpaceae. Other smaller families with the same geographical affinities are the Nepenthaceae and Chloranthaceae; while the New Caledonian members of the Orchidaceae, Palmaceae, and Pandanaceae are more closely allied to the Indo-Malayan sub-families than to those of other neighbouring regions.

On the other hand, we have equally clear relations with the flora of South-East Australia. The Myrtaceae with capsular fruits are very abundant constituents of the flora. (The Myrtaceae with fleshy fruits, which are pan-tropical with many species in Indo-Malaya, are also present in New Caledonia in plenty.) The Proteaceae number no fewer than forty-four, showing the clearest relationship with Australia, the Indo-Malay genus *Helicia* being unrepresented. The Epacridaceae (20 spp.), Dilleniaceae (21 spp.), Rutaceae (58 spp.), Goodeniaceae (4 spp.), and others also bear out the connexion, particularly with the flora of New South Wales.

It is noteworthy that the Indo-Malayan elements of the flora are chiefly represented in the forest regions, and the Australian elements in the scrub and savannah regions. Schlechter's division of the island into a north region with Indo-Malayan floristic affinities, and a south region with Australian affinities seems to depend on the dominance of forest in the north, and of scrub and savannah in the south. The littoral zone is related floristically to the Pacific area in general, and need not be further discussed here.

A consideration of the flora leads to the conclusion, supported by other lines of evidence, that New Caledonia is a very ancient land mass and has been separated from continental areas for a very long period, the date of separation apparently preceding the period in which the Compositae, Gramineae, and Papilionaceae were evolved and distributed over the earth's surface. That a land connexion previously existed appears to be certain from the wholesale nature of the resemblances of the flora to its distant neighbours, and from the fact that the majority of native New Caledonian plants have no natural distributive mechanisms which would account for their transportation over wide spaces of sea.

FAUNA. The most striking feature of the fauna is the almost complete absence of mammals. The only representatives of this group native to the island are the bats and flying-foxes (among which may be specially mentioned a species with a distinct tail), a rat and a pig, the latter two apparently dating from prehistoric times. An East Indian stag has been introduced, and is now locally abundant.

There are no marsupials nor amphibians, though the French have introduced species of frog. Land snakes are absent, but lizards are represented by several species of skink and gecko, including one of exceptional size. The birds are not numerous in species but contain representatives of most of the families. The kagou (*Rhynochetus jubatus*), is perhaps the most remarkable; its systematic position has been extremely doubtful. It has large, well-developed wings, but is entirely flightless. It can easily be captured by dogs, and for this reason is rapidly diminishing in numbers.

Among the insects the Orthoptera are represented by a remarkable variety of Mantids and Phasmids, and the Hemiptera, Diptera, and Coleoptera are also represented by large numbers of forms, but the Lepidoptera and Hymenoptera comprise comparatively few species. On the whole, there seems to be a lack of insects which depend for locomotion exclusively on flight. Myriapoda, spiders, and scorpions are all represented in some variety.

The fauna in general, like the flora, shows features which may be correlated with long isolation, viz the great development of certain peculiar genera, often of a primitive type, the large lacunae in the series, and the high degree of endemism. The geographical relationships are, on the whole, with the New Hebrides, East Australia, and the Indo-Malayan regions.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. KITTS. In his report for the month of March, the Agricultural Superintendent mentions the reaping of a plot of Indian corn in the Experiment Station which gave a yield at the rate of 4,000 lb. per acre. Plant distribution included 3,300 cane cuttings, 1,400 sweet potato and 4,600 cassava cuttings, 15 lb. Mazzagua Guinea corn, 1,405 lb. selected cotton seed, 354 lb. yams, and 20 lb. white velvet bean. In the Botanic Garden general routine work was carried on, and constant watering was necessary to keep the plants alive owing to the dry weather. Plants of *Casuarina equisetifolia* were set out along the eastern side of the station to form a wind-break. Regarding staple crops, Mr. Shepherd states that the dry weather had ripened up the cane crop and the Factory and Muscovado estates were making every effort to get the crop taken off as soon as possible. The yield continued satisfactory, and it seems that the total crop will be as large as that of last year. The young cane crop, especially the later planted was feeling the effects of the dry weather, and rain was much needed. The earlier planted canes were, however, looking well and healthy. Preparations for planting cotton were being rapidly pushed on, and there was every prospect of a larger acreage in cotton than in any previous year. Every inducement was offered to plant ground provisions and corn, but the high price of sugar and cotton seemed to make the planter lose sight of the necessity for growing such crops. Owing to the dry weather and early ripening of canes the sugar-cane experiments had to be taken off earlier this season than in past years, and during the month the plots at Molineux, Brighton, Caines, and West Farm were reaped. This entailed considerable work on the staff, and much travelling. The results have been very satisfactory. The seedling canes planted at Brighton were also cut and tested. Those canes with best field characteristics were chosen, each hole weighed, the plants saved, and the juice tested at the Laboratory. It is very interesting that many of the heaviest yielding canes had a high sucrose content. Rainfall for the month was 1.61 inches, for the year 6.16 inches.

The summary of work conducted at the Government Laboratory included analysis of fourteen samples of milk from the Inspector of Police, and examination of three samples of bay oil from Montserrat.

NEVIS. Mr. W. I. Howell, Agricultural Instructor, writing in reference to operations in the Experiment Station states that during the month of March the work continued satisfactory. Cotton in the demonstration plot was reaped and a return of 134 lb. of lint to the acre was obtained. The crop was all sold to a local purchaser. The old cotton trees were being pulled off and preparation for the next crop made. The onion crop was reaped during the latter part of the quarter and a return of above 6,000 lb. was obtained from the plot of $\frac{1}{2}$ -acre. The crop was handled by the Onion Growers' Association. A plot 1 acre in size was planted in sweet potatoes, one-half on 4-foot banks, 1 foot apart on the banks; the other half planted 1 foot apart on 4-foot banks and cross holes dug 4 feet apart between the banks, and 2 holes planted on each cross hole. The object of this experiment is to see whether larger yields cannot be obtained from closer planting. The plot, on the whole, was doing well, but had been damaged several times by stock pastured on the adjoining field. A plot of castor seed was doing fairly well; reaping had begun but the returns

from this picking would not be very good as the plants were not very large, having been planted only on December 28, 1916. Plant distribution to the end of the quarter was as follows: 9,850 sweet potato cuttings, 213 lb. Guinea corn, 30 lb. Indian corn, 8 lb. black-eye peas, 4 lb. Lima beans, 354 lb. yams, 34 lb. Para peas; and 56 lb. cotton seed. Concerning staple crops, it is stated that the cane crop, though not up to that of last year was still fairly good and good yields were obtained in some places. A much greater proportion of the crop this year was being sold to the St. Kitts factory. The question of better transit of canes across to St. Kitts was being discussed, and it is hoped that something will be done in this direction. The cotton crop throughout the island has been reaped, and a return of about 100 lb. of lint to the acre was obtained. Practically the whole crop was sold in the local market. The old cotton was being pulled off and preparation for next crop was in progress. It is estimated that not less than 3,000 acres will be put under cotton cultivation this season, but there may be some difficulty in handling the crop on account of shortage of labour. The supply of Paris green and lime stocked by the local Government was exhausted, and it is important that some arrangement be made to secure a supply of the poison, as the merchants' stock is small and being sold at 2s. 6d. per lb. The onion crop throughout the island was a success. Over 36,000 lb. of onions were handled by the Onion Growers' Association, and the price in the local market continued good throughout the season. Shipments were made to New York, Barbados, and Trinidad, where fairly good prices were obtained. Very little planting of provisions was done during the month on account of the dry weather. The crops, on the whole, continue satisfactory, but on account of the high price of cotton there is a tendency to neglect this crop, and therefore special efforts are being made to induce the small growers to continue planting provisions as in the past. The vanilla at Maddens estate continues to do well: the crop this year is estimated at $\frac{1}{2}$ -ton of cured beans. The curing under glass proved quite a success, and better results were obtained from it than curing directly in the sun. Rainfall for the month 2.57 inches, for the year to date, 7.24 inches.

VIRGIN ISLANDS. In his report for the month of March Mr. W. C. Fishlock states that weather and other conditions were adverse to work in the Experiment Stations. There was no plant distribution. For similar reasons there was little to report in connexion with staple crops. Following the gale of October 9 last year came heavy rains—and since then, drought. A visit in connexion with the Profit-Sharing Scheme (Cotton Industry) was paid to Jost van Dykes and a meeting of the people addressed. Rainfall for the month 1.52 inches, as compared with 2.41 inches, the average for the month for the previous sixteen years.

In his quarterly report for the period ended March 31, Mr. Fishlock gives some details regarding the condition and progress of the plots at the Experimental Stations. As showing how complete was the destruction of the cotton plants by the hurricane, only 70 lb. of seed-cotton were picked from an area of close upon 5 acres. In regard to the coco-nut demonstration plot, detailed observations have been made as to the number of palms damaged and destroyed. A summary of the condition of the four plots is as follows: the number of palms originally planted was 489; at the present time out of these 489 trees there are only 61 or 12 per cent. in good condition. In moderate condition there are 123 or 25 per cent.; in poor condition 121 or 25 per cent.; dead 184 or 38 per cent. It is stated that already 128 holes have been dug for replanting as soon as favourable weather occurs. In regard to the onion industry, in spite of the set-back due

to the hurricane, 106,000 onion seedlings were distributed during the season. The small growers were shipping their onions direct to St. Thomas where high prices were ruling. Concerning the cotton industry Mr. Fishlock says that this has passed through a critical stage. In present circumstances a straight cash payment is more acceptable than a first payment of 5c. and a distribution of profits afterwards. It is one of the reasons why a considerable amount of cotton was sold to a private buyer instead of being sent to the Government ginnery. The weather at Tortola during the quarter was dry, the total rainfall during the period January-March inclusive being only 5.06 inches, which is 3.34 inches below the average for the previous fifteen years.

AGE DETERMINATION OF CATTLE IN DIFFERENT COUNTRIES.

It appears that the dentition formulae for age determination of cattle vary according to breed and environment. An article published in the *Agricultural Journal of Egypt* (Vol. VI, 1916) deals with the question of age determination in Egyptian cattle. From this it would seem that the matter is one deserving of investigation in the West Indies, for it appears certain that the commonly employed dentition formulae of Europe do not hold good for Egyptian cattle, and probably less so for Indian and those breeds generally found throughout the tropics.

The article under notice discusses first of all the methods of ageing employed by Egyptian dealers and farmers. When a dealer in an Egyptian cattle market requires to age a cow or a bull, he simply looks at the animal carefully without necessarily touching it, and then pronounces its age on its general appearance. The dealers believe that such cursory examination is sufficient to estimate the age of the animal, relying on long experience. This method cannot by any means be exact, because even with the greatest experience the estimation of age becomes a matter of opinion. Another method is to estimate the age of cows by the number of calvings. It is reckoned that heifers usually become mature when they are about two years old. They are usually served early in their third year, so the first calf will come about the end of the third year. This method would be of some value if the cow had a calf every year, and also if the owner stated the right number of calvings.

The reliable methods of determining the age of cattle are by the horns and by the teeth. Determining age by the horns is more useful after the shedding of all the incisors. But usually Egyptian cattle are tied up and led by the horns—conditions which affect their normal growth. It is only in a few instances that one could count the rings on the horns. At any rate the rule is to add two to the number of rings, and the result will be the age of the animal.

By far the most reliable method is, of course, by means of the teeth. The classical word in Arabic for ageing is *tasine* (teething). The Arabs had very reliable observations on camel and horse teeth. They also mention cattle, although they seem to have had more interest in the first two kinds of animals. Below will be found a comparative table with European and American cattle, which shows briefly the ageing dealt with in the article under notice. It may not be out of place to mention here, that there are two sets of teeth in cattle: temporary or milk teeth, and permanent teeth, the latter being larger and much wider and more yellow in colour than the temporary teeth. The teeth are of two kinds: incisors, which are shovel-shaped, eight in number and found at the

extremity of the lower jaw; and the molars, which are twenty-four in number—twelve in each jaw.

The table referred to, is as follows:—

A.—Egyptian cattle.

Milk teeth:—

- | | |
|---|-----------------|
| (1) Centrals, middle laterals, and laterals | up at birth. |
| (2) Corners | up at one week. |

Permanent teeth:—

- | | |
|-----------------------|---|
| (1) Centrals | up at two years. |
| (2) Middle laterals | up at three years. |
| (3) External laterals | up at three years six months to four years. |
| (4) Corners | up at four years three months to four years six months. |

B.—European cattle (according to Brown's 'Table of Dentition').

Permanent teeth:—

- | | |
|-----------------------|--|
| (1) Centrals | cut at one year six months, well up at one year nine months. |
| (2) Middle laterals | up at two years three months |
| (3) External laterals | cut at two years eight months. |
| (4) Corners | up exceeding three years |

C.—American cattle (according to 'Diseases of Animals'; by Professor L. H. Baily).

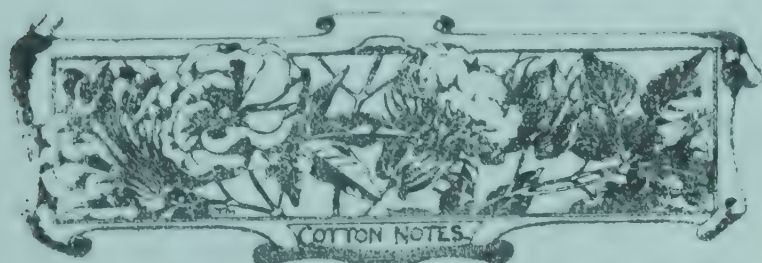
Milk teeth:—

- | | |
|-----------------------|--------------------|
| (1) Centrals | up at birth. |
| (2) Middle laterals | up at one week. |
| (3) External laterals | up at two weeks. |
| (4) Corners | up at three weeks. |

Permanent teeth:—

- | | |
|-----------------------|--|
| (1) Centrals | up at one year to one year six months. |
| (2) Middle laterals | up at two years six months. |
| (3) External laterals | up at three years. |
| (4) Corners | up at three years six months. |

A note appears in *Nature* for March 29 to the effect that the President of the Board of Agriculture and Fisheries of England and Wales has appointed a Committee to consider practical means for increasing the supplies of sea-fish for the home markets, and for encouraging the consumption of such fish, whether cured or fresh, in substitution for other foods. The committee is also concerned with increasing the amount of fresh-water fish supplied, and is empowered to provide machinery and labour to make the supplies available and for their transport to market. It would be easy for the West Indies to take similar action. In these islands locally caught fish could well be substituted for much of the cured fish imported if the fishing industries were better organized.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland, of Liverpool, write as follows, under dates March 20 and April 3, 1917, respectively, with reference to the sales of West Indian Sea Island cotton:—

There has been a keen enquiry from spinners for West Indian Sea Island cotton, and a clean quality from Nevis, Montserrat, Anguilla, Antigua and St. Croix is worth 37*d.* to 38*d.*, Barbados 38*d.* to 39*d.*, St. Kitts 39*d.* to 40*d.*, and the best ordinary St. Vincent is nominally worth 40*d.* to 42*d.*

There is no doubt that the consumption much exceeds the possible supply.

Sea Island cotton continues in demand and is dearer, the official quotations being raised 2*d.* per lb. this week.

SEA ISLAND COTTON PROSPECTS.

Advices recently to hand, indicating a further advance in the prices of West Indian Sea Island cotton to as much as 44*d.* per lb. for the highest grade will act as a further stimulus for greater extension this season. It is reported on another page in this issue that no less than 2,000 acres were planted in Nevis by the beginning of April, which shows the interest now existing in Sea Island cotton. In many places the peasants are putting land ordinarily planted in ground provisions under cotton, so attractive are the prospects in regard to this crop. It is hoped that the early planted cotton will not suffer from the drought that has existed now for some months. June is the usual month to plant cotton, and in St. Vincent and Montserrat legislation exists to enforce a close season. It appears that the high price of cotton is due primarily to the shortage in Egyptian Sakel, but it is understood that very large areas are now being planted in Egypt which may tend to lower the price of fine staple cottons next year. However, the demand for this class of cotton will tend to increase chiefly on account of increased activities in regard to aeroplane and motor tire construction.

There is no doubt that planters will be well advised to grow as much cotton as possible this year. As already intimated, it is clear that there will be a considerable increase in the area planted this season in St. Kitts-Nevis, and probably in all the cotton-growing islands.

The following remarks, made by Mr. J. Hutton, Secretary, British Cotton Growing Association, before the members of the Manchester Athenæum Club on February 16 last, and reproduced in the *West India Committee Circular*, may be of interest to readers of this Journal. Referring to the need for maintaining the West Indian supply, he said:—

‘He was sorry to say that some of the consumers in this country had shown a lack of foresight in the matter.

They had not recognized that the day must come when they would be also absolutely dependent on the West Indies for their future supplies. The boll weevil was gradually but steadily advancing over the cotton States of America, and it was only a question of time before it reached the Atlantic. When that day came we should probably see the disappearance of the cultivation of Sea Island cotton in America. One would have naturally thought that under these circumstances they would have erred on the generous side, and would have given more than a preference to the cotton grown by their fellow-countrymen on the other side of the Atlantic. He regretted to say that frequently during recent years cotton had been left on the Association’s hands unsold for months together. This naturally had been most discouraging to the planters, and the Association had been most unfairly blamed for what had occurred.

‘When war broke out there was an immediate cessation in the demand for luxuries, and consequently Sea Island cotton was almost unsaleable. There had since been a big rise in prices, but many of the planters were much discouraged, and, attracted by the high price of sugar and other products, reduced their acreage under cotton, and in some cases abandoned it altogether for other crops. The total crop last season was only 3,600 bales.

‘As regards the future, he was convinced that the demand for this type of cotton was bound to increase. He could also confidently say that the West Indies could produce all the Sea Island cotton we required, but this depended entirely on the price, and whether the industry was sufficiently remunerative to the planters. In other words, if the spinner wanted the cotton, he must be prepared to pay a fair price for it, and it was also essential that the planter should get a ready market for his produce. The Association would help him to the best of their ability in financing and marketing the crop, and it would be more than a misfortune for the West Indies if the Association were unable to continue this work.’

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and fifty-seventh meeting of the Council was held at the Offices, 15, Cross Street, Manchester, on Tuesday, the 6th inst. A letter from Lord Derby was read regretting his inability to attend the meeting, and apologising for his absence. In the absence of the President, Mr. J. Arthur Hutton occupied the Chair.

It was reported that following the deputation to the Board of Trade on February 8, a letter has been received from the Board of Trade stating that a Committee is being appointed to enquire into the best method of developing the cotton-growing resources of the Empire.

WEST AFRICA. With regard to the question of shipments of cotton seed, it was reported that a consignment of about 500 tons had now been forwarded. The Association have several thousand tons of cotton seed at their various ginneries in Africa, representing over £150,000 in value, most of which is valuable as foodstuffs, and which will be wasted if it cannot be shipped. Under present conditions, however, it is essential that ships should be principally used for bringing the most useful articles of food to this country.

A cable has been received from the Association’s Manager in Lagos stating that heavy storms of wind and rain have seriously damaged the unpicked portion of the cotton crop, which will fall short of estimates. It was pointed out that this cable only referred to the Lagos

Section of Nigeria, and there is no reason to believe that the cotton crop in the other sections has suffered from the climatic conditions, and the reports as to the growing crop in Northern Nigeria have been very encouraging.

The purchases of cotton in Lagos to February 28 amounted to 804 bales, as compared with 1,365 bales for the same period of last year, and 165 bales to February 1915.

In Northern Nigeria, the purchases to February 24 amounted to 2,213 bales, as compared with 4,490 bales to the end of February last year, and 88 bales to February 1915. It was reported that the crop this year is about a month later than in the previous season.

UGANDA There has recently been an improvement in the shipping facilities from Mombasa, and all the Association's cotton bought last season has now been shipped with the exception of about 1,200 bales.

SUDAN. Reports from the Sudan Plantations Syndicate for December were read, stating that the crop has suffered from the exceptionally cold weather which has been experienced, and considerable damage has been done by aphids.

NYASALAND. Mr Percival, the Association's Manager in Nyasaland, is now in this country on leave of absence, and reports that notwithstanding the withdrawal of labour for military operations, the prospects for cotton during the coming season are quite good. Prior to last year, cotton had gone out of favour among the European planters in Nyasaland owing to low prices, but with the increased values in 1916 there came an improvement, and it is expected that planters will increase their acreage for the coming season. A considerable increase is also anticipated in the native cultivation in the Chiromo, West Shire, and Port Herald districts. The quality of the cotton grown during the past season was not so good, owing to unfavourable climatic conditions, and the cotton had suffered from unusual pests, including the cotton leaf beetle, and four kinds of boll worm. Generally speaking, the prospects for the coming season are equal to if not better than in any previous year, and with the construction of additional railways, there are prospects of a substantial increase in the native cotton crop.

A statement was submitted showing that 1,708 bales of cotton had been sold in the month.

Agriculture in Queensland.—The total area of land in Queensland under cultivation during 1915 was 1,059,431 acres, an excess of 78,183 acres over the preceding year—an increase that was to a great extent due to the encouragements given in 1915 by the Government to add to the land under wheat so as to, as far as possible, make Queensland self-supporting and release a corresponding quantity for the use of Great Britain during the War. In acreage and in production, bananas rose from 7,796 acres to 8,166 acres; pine-apples from 3,423 acres to 3,709 acres; and apples from 2,020 acres to 2,170 acres. The produce per acre from the bananas and pine-apples, too, was greater upon an average than for the preceding year, bananas producing 148 bunches to the acre, as against 136 bunches, and pine-apples 248 dozen as against 240 dozen. The average annual yield during the last decade of wheat has been 12.36 bushels to the acre. For maize there has been an average annual return of 21.50 bushels for ten years. The total value of crops in Queensland of all kinds in 1915, upon figures supplied by the growers, stood at £5,023,304, and in 1914 at £5,679,783. The total area under cultivation, newly broken up, fallow, or lying idle, was 1,364,587 acres, an increase of 93,222 acres, of which 729,588 acres were under crops of various kinds.

SOIL EVOLUTION IN VOLCANIC DISTRICTS.

The characteristics of the soil in the area devastated by the St. Vincent Soufrière in 1902-3 have been studied by Dr. H. A. Tempany, lately Government Chemist and Superintendent for the Leeward Islands, and an account of this work appears in the recently issued number of the *West Indian Bulletin* (Vol. XVI, No. 2). The following is a summary of the results:—

The areas from which the samples were taken have already undergone a fair degree of transformation into soil, and are covered with a growth of vines and bush. The deposits vary in thickness from 14 to 18 inches; the samples taken represent the thickness of the deposits, but do not include any of the original underlying soil.

The samples were submitted to physical and chemical analyses, while the shrinkage, lime requirement, nitrogen-fixing power, ammonifying power, and nitrifying power were also investigated.

Physically the soils were found to consist of coarse sandy types; they showed shrinkages ranging between 1 and 2 per cent., thereby indicating the formation of a certain amount of colloidal material.

Chemically the soils showed small contents of organic carbon and nitrogen; they were extremely deficient in calcium carbonate; they showed the presence of moderate amounts of available phosphoric acid and potash.

Characteristically the soils all possessed an appreciable degree of acidity, as evidenced by the lime requirement for neutralization.

The biological activity of the soils was found to be as follows: the value for the figure for partial sterilization indicated the existence of a moderate activity in respect of putrefactive bacteria. Nitrogen-fixing organisms of the *Azotobacter* type were found to be present, and the soils showed small but appreciable nitrogen-fixing power. The soils also possessed appreciable ammonifying power, but were completely deficient in nitrifying power.

During the fourteen years which have intervened between the eruption and the date on which the samples were taken, considerable progress has been made in the conversion of the sterile ash deposits then laid down, into fertile soil.

The means by which this change has been accomplished are briefly discussed, and the relationships indicated thereby to the origin of the very rich soils characteristic of the forest lands of the West Indian islands, are considered. The acid condition of the soil and the absence of nitrification are alluded to, and the possibility of such soils being built up without the active intervention of nitrifying organisms is indicated.

The Divining Rod in Queensland.—According to the London correspondent of the *North Queensland Register*, the Queensland Agricultural Department has undertaken the work of locating sites for wells and bores for settlers, and in August 1915 two officers were detailed for this purpose. The divining rod and the Mansfield automatic water finder are both used, and from August to December 1915 as many as 348 sites were selected, of which 60 were tested, 53 with success. Since then the divining rod has been employed, by both State and private settlers, and considerable success has attended its use.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue deals with the subject of resistance to disease, and indicates new lines along which entomological and mycological research might usefully be conducted.

On page 131 will be found an interesting article describing the plants and animals of New Caledonia, one of the South Pacific Islands.

The Report on Sugar-cane Experiments in the Leeward Islands, 1915-16, will be found reviewed on page 141.

Under Insect Notes, on page 138, will be found a survey of the prevalence of pests in the West Indies during 1916. Plant Diseases deal with citrus diseases in Cuba.

Scientific Exploration in Central America and the West Indies.

The expedition which the American Museum of Natural History has maintained for the last six months in Nicaragua has returned to New York, according to *Nature*, bringing with it a collection of 1,500 fishes and 2,000 reptiles, together with a large series of photographs and unusually complete oecological notes. The material thus obtained is said to be of special value, as no specimens of reptiles had ever before been brought out of this region, although it has a reptile fauna of no ordinary interest, not only because of the great diversity in the typographical features, but also because the isthmus to-day forms a transition tract between the two continents, and is supposed in the past to have had land connexion with Cuba and Jamaica.

In connexion with the above, it may be stated that a party of marine biologists in the United States contemplate visiting Barbados in 1918 for the purpose of studying coral reefs and other shallow-water forms of life.

Open-air Pig-keeping.

It has been suggested in connexion with proposals to establish a bacon factory in the West Indies, that it might prove profitable to keep pigs in herds on pasture land, or on sweet potato fields rather than in sties. It has also been suggested that pigs might be raised on coco-nut estates provided adequate protection could be given to the trees. Concerning these ideas, an article on open-air pig-raising appearing in the *Journal of the Board of Agriculture* of England and Wales (March 1917) is of interest.

It is stated in this article that the increase in the number of pigs which can be maintained on pasture as compared with the number which can be maintained in sties on an equal quantity of food is rather over 30 per cent. This figure is based on the results of a considerable amount of practical experience, which tends to show that a pig fed in a sty requires an additional quantity of at least 200 lb. of barley meal to attain an equal weight to a pig running on grass. Assuming that one million pigs could be grazed, the quantity of barley meal thereby rendered available for other purposes, compared with a million pigs fed in sties, would be approximately 100,000 tons—a consideration of great importance. (Barley meal is here taken as an illustration; the corresponding quantities of other foods may be calculated on their feeding values.)

The advantages of open-air, as compared with sty feeding, may be shortly stated as follows:—

- (1) The capital expenditure is small, being for hut and hurdles approximately £1 per pig.
- (2) The grass substituted for the 200 lb. of barley meal remains at pre-war price (say 3s. per pig, on the average).
- (3) There is no waste of manurial constituents.
- (4) There is less risk of disease.
- (5) The number of pigs usually maintained can be materially increased.

(6) The pasture is greatly benefited, and cattle soon grazed closely where pigs have been folded.

Altogether open-air pig-keeping would appear to be the cheapest and most effective way of raising large numbers of those animals.

Supply of Ground Provisions at Barbados.

The Barbados *Advocate* for Saturday, April 21, publishes a Minute by His Honour Sir William Chandler, Kt., C.M.G., President of the Legislative Council of that Colony, dated March 20, describing the position of the colony as regards the supply of ground provisions, and covering a circular letter forwarded by him to the attorney or manager of every sugar plantation in the island, appealing to them to state the minimum number of acres on the estates under their control, which they would plant in potatoes in April, May, or June this year, with a view to meeting the probable shortage in food supply, consequent on the very high price of wheat flour, meal, etc., and the increasing difficulties of getting freight for sufficient imported foodstuffs for the island, at the end of the crop season.

From the Return annexed to the Minute, it is seen that the planters who have replied have pledged themselves to plant (weather permitting) before the end of June next, 2,430 acres of sweet potatoes. As to the amount of produce obtainable from this acreage, taking the average number of cane holes per acre over the whole island as 1,400, and the average return of sweet potatoes per hole as 8 lb., it is estimated that the average return would be about 11,200 lb. or 5 tons per acre, or a total of 12,150 tons. Sweet potatoes as a general rule, are edible when four months old, and will keep in the ground remaining edible until seven months old. If, therefore, it is argued, fairly equal quantities of the 2,430 acres above referred to, were planted in March, April, May, and June, there should be a plentiful supply of sweet potatoes available for consumption in the months of August, September, October and November. It may be remarked, however, that weather conditions have so far been against planting operations in March and April.

It is pointed out that the above allocation of 2,430 acres to sweet potato cultivation this year, has no reference to what is called the planting of 'fall potatoes', by which is meant the planting of potatoes in land from which canes have been reaped, but which is to be thrown out of cane cultivation for a year, and in the case of the current year, not to be planted in canes until November 1918, for reaping in 1920. The 'fall planting' would appear to be the customary practice on sugar plantations at Barbados; hence the 2,430 acres proposed to be appropriated this year will be additional to the normal area devoted to potato cultivation annually in the colony.

Attention is called to the alleged disinclination of the plantation labourers to do anything else but cane

reaping and sugar-manufacturing operations during the crop season. This, of course, is a difficulty that will have to be coped with and overcome. It might be mentioned that there are certain proposals that have been submitted by the local Government making compulsory the increased cultivation of ground provisions, which now await consideration of the Barbados Legislature. In most of the other colonies steps have already been taken in connexion with the increased production of local food supplies.

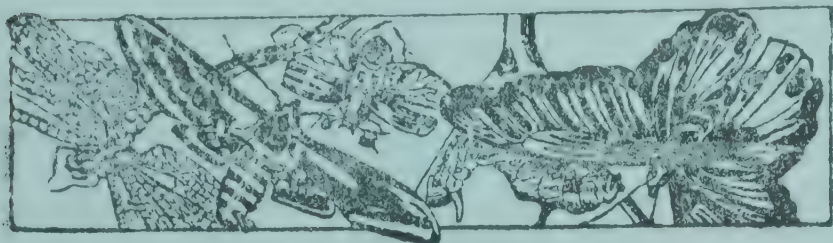
Potash Fertilizers from Felspars.

The dearth of potassium salts in Great Britain owing to the war has caused renewed attention to be devoted to the possibilities of preparing soluble potassium salts from the large deposits of felspar which are found in certain parts of the country. It is pointed out in *Nature* that the problem has occupied the attention of chemists intermittently for many years, but the processes devised in the past have proved commercially unsuccessful, owing largely to the failure to obtain, along with the potash salts, other saleable products which might share the cost of manufacture. This difficulty would appear to have been largely overcome in the process patented by Mr. J. Rhodin, a Swedish inventor, in which, along with the soluble potassium salts, a marketable white cement is obtained. The successful results obtained by this process with Swedish felspars have been brought to the notice of the Board of Agriculture and Fisheries, and under the auspices of a sub-committee of the Fertilizers Committee of the Board, further tests with British felspars from Roche in Cornwall, and Loch Eriboll, in Sutherlandshire have been carried out, the results of which are summarized in the February issue of the *Journal of the Board of Agriculture*.

The Roche felspar, containing 10.8 per cent. K_2O , yielded 75 per cent. in a soluble form, whilst the Loch Eriboll spar, with 8.6 per cent. K_2O gave 60 per cent. soluble. Swedish spar with 12.9 per cent. K_2O yielded 54 per cent. in a soluble form. Expert opinion described the cement as a true hydraulic cement, of satisfactory colour, but of much lower tensile strength than Portland cement.

As a result of its examination, the sub-committee expresses the opinion that encouragement should be given to any movement for the manufacture of potash and white cement by the Rhodin process on a commercial scale, and that in the event of a public company applying to the Treasury for permission to raise capital to work this process, the application should receive the strong support of the Fertilizers Committee.

It may be mentioned that potash manures are much needed at present for potato growing.



INSECT NOTES.

INSECT PESTS IN THE WEST INDIES IN 1916.

The Annual Report on the prevalence of some pests and diseases in the West Indies during 1916 will be published in the *West Indian Bulletin* at a later date. Meanwhile it seems advisable to give some brief notes on the more important insects of the past year as observed and reported on by the Agricultural Officers in the various islands.

SUGAR-CANE.

The grubs of the Antigua brown hard back (*Lachnosterna* sp.) were common in the north-eastern portion of that island and were especially prevalent in the heavy lands towards the central districts. The Mycologist and the Entomologist of this Department visited Antigua in March 1916, and during their visit the scoliid parasite, probably *Tiphia parallela*, was found to be established in a portion of the infested district. The recommendations suggested for the control of the *Lachnosterna* grubs included rotation of crops, better drainage of all heavy lands, the application of pen manure where available, the use of a trap crop, such as maize, the collection of grubs, and the encouragement of insect parasites.

An outbreak of froghoppers (*Tomasaspis saccharina*, Distant) occurred in Grenada in November and was investigated by C. B. Williams, who went over from Trinidad. The froghoppers were found to be fairly well distributed throughout the island, but actual damage occurred on only two estates. An account of the outbreak appeared in No. 389 of the *Agricultural News*.

Grasshoppers were very prevalent in St. Kitts early in the year and caused much damage to the young canes in one district. A poisoned bait of bran and Paris green was successful where used.

The cotton worm (*Alabama argillacea*, Hübn.) was prevalent in St. Vincent and Antigua, severe attacks being experienced in some localities. This insect also appeared in Montserrat, but was effectively controlled by poisons. In St. Kitts very little damage was done by this pest which was materially controlled by the Jack Spaniard (*Polistes crinitus*). Cotton stainers (*Dysdercus delawarensis*, Leth.) were a serious pest during the year in St. Vincent. The vigorous campaign against them included the destruction of their wild food plants, chiefly the silk-cotton tree (*Eriodendron anfractuosum*) and the John Bull (*Thespesia populnea*). These insects were prevalent in Montserrat towards the end of the year, but on the whole did less damage than for many years. The hand-picking of stainers carried out during the early part of the season seems to have had good results. Little damage was done by stainers either in Antigua or St. Kitts during the year.

The leaf-blister mite (*Eriophyes gossypii*, Banks) was abundant on all cultivations in the Virgin Islands. Although occurring generally in most of the cotton-growing islands, this mite can no longer be regarded as a serious pest of cotton.

CACAO.

The cacao thrips (*Heliothrips rubrocinctus*, Giard.) was generally distributed and locally severe in Grenada and St. Vincent, and can usually be found in St. Lucia and Dominica.

LIMES AND OTHER CITRUS TREES.

Scale insects were generally present on lime trees in those islands where this crop is of any importance, but there were no severe attacks in 1916. In Dominica young trees often suffer from these insects, but generally in places where the soil is in poor condition. Assisted by good cultural methods the trees can usually throw off these attacks. In St. Lucia the heavy rains which fell from June to October checked the snow and mussel scales, perhaps because the conditions were favourable for the development of their fungus enemies. Serious attacks of the Lantana bug (*Orthezia insignis*, Dougl.) occurred in the leeward district of Montserrat from April to June, and were followed by 'black blight'.

The bark borer (*Leptostylus praemorsus* Fabr.) was generally distributed in St. Lucia, and severe attacks occurred in several districts of that island.

Weevils belonging to the genus *Diaprepes* caused damage to young lime trees in most of the citrus-growing islands. The adults feed on the leaves of young trees while the grubs damage the roots. In Montserrat and Antigua large numbers of these beetles were collected and destroyed.

Mole crickets (*Scapteriscus didactylus*, Latr.) caused serious losses to lime seedlings in St. Lucia.

INDIAN CORN OR MAIZE.

Caterpillars were generally present on corn in all the islands except Dominica and the Virgin Islands, and at times they were serious pests in some localities. These are usually *Heliothis obsoleta* and *H. armiger*.

In St. Vincent corn was attacked by *Laphygma frugiperda*, S and A., and by mole crickets. Both of these insects were severe in some localities.

The sugar-cane moth borer (*Diatraea saccharalis*, Fabr.) is recorded as injuring corn in Grenada and Carriacou.

Grubs of the brown hard back (*Lachnosterna* sp.) were responsible for considerable damage to corn roots in the central districts of Antigua.

COCO-NUTS.

The coco-nut white fly (*Aleurodicus cocois*, Curtis), occurred in Grenada and Carriacou, and was common on young palms in St. Lucia without doing any serious damage.

Aspidiotus destructor, Sign., was generally distributed in all the islands, except Montserrat and St. Kitts, and severe local attacks were felt in Grenada, St. Vincent and the Virgin Islands.

SWEET POTATOES.

The Scarabee or Jacobs (*Euscepes batatae*, Waterhouse) was common in potatoes grown on peasant holdings in Antigua, but those grown on estates were generally free from this pest.

The larvae of the small moth *Sylepta helcitalis* were reported as damaging sweet potatoes in Montserrat.

GREEN DRESSINGS.

The larvae of the woolly pyrol moth (*Anticarsia* [*Thermesia*] *gemmatilis*, Hübn.) attacked horse beans in some parts of Grenada, and were destructive to Bengal beans in Montserrat towards the end of the year. Green dressings were attacked by larvae of *Baliovia cistipennis* in St. Vincent, in some cases severely.

ONIONS.

The onion thrips (*Thrips tabaci*, Lind.) was severe in Antigua during the early part of the year, and was troublesome in the dry season in the Virgin Islands.

MISCELLANEOUS.

The large Cerambycid borer, *Batocera rubus*, is reported to be spreading rapidly in the Virgin Islands. It attacks trees of *Ficus* sp., papaw (*Carica Papaya*) and hog plum (*Spondias lutea*) among others.

Slugs or 'leather jackets' (*Veronicella occidentalis*) were destructive to vegetable gardens in St. Lucia and Dominica. Domestic ducks are sometimes kept to control this pest.

THE DATE PALM IN EGYPT.

Although the date palm (*Phoenix dactylifera*) is not a native of the West Indies, its natural home being in the dry, hot regions of Northern Africa, yet it has been shown that the tree can be successfully grown in suitable situations, and at the Botanic Stations of Jamaica, Trinidad and Dominica, fruit of good quality has been produced of recent years. It should therefore be of interest to residents in these colonies to know something of the various kinds of dates which are extensively grown in Egypt. Data concerning these are given in the *Agricultural Journal of Egypt*, Vol. VI, 1916. Date palms grown in Egypt are herein classified under three heads, as follows: (1) dry; (2) semi-dry; and (3) soft.

Dry dates contain a high proportion of sugar, and are therefore easily preserved by natural means. Continued exposure to the sun causes them to become quite dry, in which state they may be kept for an indefinite length of time. In Egypt they are known as *balah nāshif*. Although good varieties, such as the Gondaila and Sakkoti, are sweet and pleasing to the taste, they are not looked upon with favour by the Europeans on account of their dryness. When steeped in water, however, they become quite soft, and many people who use dry dates in this way prefer them to other kinds.

The semi-dry dates are similar to the dry dates. They are, however, softer than the latter, and consequently may be eaten with ease. In a dried state they may be packed loosely in boxes or sacks without fermentation taking place. In Egypt the semi-dry dates are usually distinguished as *tamr*, although consumers sometimes use this word for the dry dates also. The greater part of the dates which are exported to Europe is made up of the *Amry*. In this country the most important varieties of *tamr* dates are the *Amry* and *Aglāni*.

Soft dates contain a comparatively small proportion of sugar and are not easily dried by natural means. They are therefore eaten in a fresh state or made into *agwa*—pressed dates. The majority of soft dates may be eaten as soon as they have reached their full size and colour. In fact the fruit of a few varieties, such as the Dueki, may be eaten before it has attained its full size. On the other hand, certain varieties, such as the Amhāt, are too astringent to be eaten before they are quite ripe, even by those who are accustomed to the taste of dates in the yellow or red state. Technically, it is not quite correct to speak of dates being unripe in this state.

In the unripe condition the fruits are known in Arabic as *balah neroor* or *balah bisr*, although they are most generally distinguished as merely *ahmar* (red) and *asfar* (yellow). In the final stage of ripeness when they have become succulent and translucent, they are known as *balah rutab*.

Cultivators have no difficulty in distinguishing, without seeing the fruit, the trees of different varieties of date palms, and any intelligent observer cannot fail to note the diversity in the general appearance of the trees in a palm grove of mixed kinds. This diversity of appearance is due to many points of difference in the leaves and trunk. Although these differences are in some cases matters of degree, they are sufficiently marked to make each variety quite distinct to the eye of a trained worker.

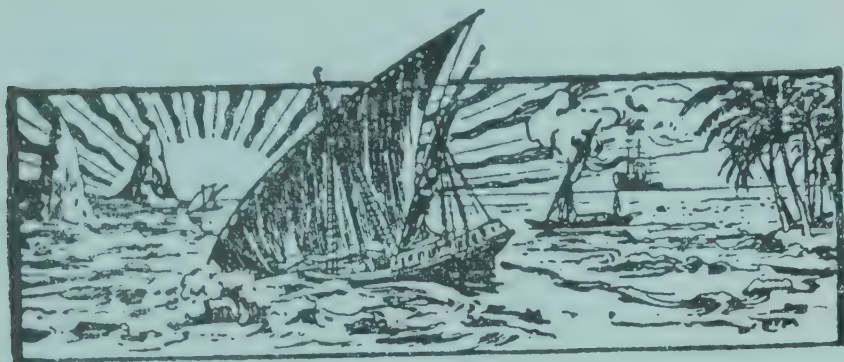
Apart from the Sudan, the cultivation of the above-mentioned dates on a large scale is confined almost entirely to the Province of Aswān, and to Nubia. Owing probably to the greater heat, the yield of the palms appears to be more greatly affected in Aswān Province than farther north by the lack or otherwise of a plentiful supply of water. Although the prosperity of this Province depends to a great extent upon the date industry, the needs of the palm in regard to manure receive much less attention here than elsewhere. In fact it may truly be said that in no other part of the country is the date palm left so much to the care of nature. The yield of individual palms varies with the following conditions: the presence or absence of wells or other means of summer irrigation; whether the palms stand singly or in groups; and whether other crops are grown and manured between the trees. The most important factor, however, in the production of good crops throughout the Province is the Nile flood, the occurrence of a low flood causing the palms to be poorly supplied with water, which naturally leads to a great reduction in the yield of fruit. In 1915 the average yield of 104 palms of which there are records was 70.9 lb. per tree. In 1914 the average crop of forty-five trees was 80.5 lb. each, and in 1913, thirty-eight trees gave an average yield of 98.6 lb. It is, however, common for trees that are well cared for to give 170 lb. or more of dried fruit each; on the other hand, trees which are growing under unfavourable conditions may not give 30 lb. each in a bad year.

The fruit commences to ripen early in September. Dried dates remain on the trees until they have passed the ripe stage and they become almost hard. The bunch is then cut, the dates are allowed to dry two to three days on the bunch, after which they are picked and spread on the ground, which is covered with ashes. The fruit is turned over every four to five days for a period of five to six weeks or even longer. It is then stored in sacks or heaps until it is shipped to Cairo or elsewhere for sale. Invariably in storing, care is taken to mix a quantity of wood ashes with the fruit. The highest prices are usually paid for the *Gondaila* and *Bartāmoada*, and the lowest for the *Gargoadā*.


A sweet beverage is made by soaking the Sakkoti dates in cold water for five to six hours. The dates are afterwards eaten, and in this state they are both soft and palatable, even to the European taste.

The chief kinds of semi-dry dates which are cultivated are the *Amry* and *Aglāni*. The yield of the *Amry* date palms varies between 2 and 5 kelās of dried dates, say 70 to 150 lb. per tree; that of the *Aglāni* is 2 to 6 kelās each, that is 75 to 225 lb. of dried dates per tree.

In regard to soft dates, the varieties cultivated are: *Bint Aisha*, *Hayāni*, *Samani*, *Zaghlood*, *Amhat*, *-Siwi*, and *Saidi*. The last named is by far the most important date tree in all the Oases. It is very closely allied to the *Siwi*, but the fruit has a thinner skin and is sweeter than that of the *Siwi*. Although the two varieties agree in almost all features, yet the *Saidi* trees differ from those of the *Siwi* in appearance. The yield of *Saidi* date trees is said to vary between 90 and 160 lb. per tree.



GLEANINGS.

 Previous to the outbreak of war, Japan imported large quantities of wheat and wheat flour from the United States, but now, according to *The Board of Trade Journal*, the position is reversed, and Japan ships large quantities of home-grown wheat and South Manchurian wheat to the United States. This has created a boom in the Japanese wheat market.

An Order issued by the Government of the Philippine Islands contains regulations and instructions for enforcing an Act providing for the granting of ten-year concessions for the fishing for, collecting or gathering of sponges. The new order, according to *The Board of Trade Journal*, deals with the making of applications for sponging concessions, sorting of sponges, collection and payment of fees.

According to *Nature* for March 29, the Departments of Geography and Anthropology at Oxford have published their arrangements for next term. In geography, lectures will be given on map projections, the historical geography of Europe, the West Indies, and British lands around the Indian Ocean. This may be of interest to readers concerned with education.

Persons requiring information regarding broom corn should refer to *Farmer's Bulletin* 768, Bureau of Plant Industry, United States Department of Agriculture. Broom corn, as its name implies, gives the fibre used in making brushes, and is a very profitable crop under some circumstances. The requirements of broom corn differ little from other sorghums, making growth best in a warm, sunny climate. It is both drought-resistant and drought-evasive.

In the European news letter to the *Louisiana Planter* for March 3, Dr. Prinsen Geerligs refers to the statements made in the *Agricultural News* regarding the extension of the area under sugar-cane in the West Indies. It is mentioned that the West Indian sugar industry is not likely to be benefited as a whole unless properly equipped factories are constructed to deal with the cane produced. It is likely, however, that for some time even the muscovado manufacturer will derive good profits from the production of even that grade of sugar.

The *Port-of-Spain Gazette* refers to activities on the part of the Trinidad Department of Agriculture to get more agricultural banks formed in the Colony. A meeting has recently been held at Caura with the object of explaining how these institutions benefit the peasantry and the procedure to be followed in establishing a bank in accordance with the provisions of the Agricultural Credit Society's Ordinance. Readers will be aware that agricultural banks established on the Raiffeisen principle are now to be found working successfully in St. Vincent, St. Lucia and Trinidad.

The onion industry of Barbados is referred to in the Report of the Barbados Department of Agriculture for the year 1915-16. The amount of onions grown is remarkably small compared with the production of this vegetable in the Leeward Islands, and taking into account the big local demand in Barbados. It might be possible to establish an association in Barbados provided a sufficient number of growers living near enough together could be persuaded to take up the industry seriously. Onions might be grown as a catch crop with sugar-cane in Barbados as they are in Antigua.

Coincident with the introduction of alfalfa into the various sections of the United States, there developed an interest in varieties or strains for special conditions. According to a note in the *English Board of Trade Journal*, this has resulted in the recognition of at least nine distinct commercial varieties showing great diversity in their adaptations to climatic conditions. It may be possible that strains adapted for growing in hot dry regions may now exist and be found suitable for cultivation in certain parts of the West Indies. Previous trials with alfalfa, even Arabian seed, have not been successful in the West Indies.

Of considerable interest in the West Indies are the Blue Books of the Canadian Department of Trade and Commerce for the year 1916. One of these just received deals with Canadian trade with France, the United Kingdom, the United States and Germany. The publication contains a summary also of Canada's trade with the world. Since the war this has increased to a very great extent. The total exports in 1913, for example, were valued at \$377,068,355, and this rose steadily up to \$779,300,070 in 1916. Whereas the trade with Germany has dwindled down to nothing, that with the United Kingdom and France has shown an extraordinary increase.

The *Experiment Station Record* (Vol. XXXV, No. 9) refers to Books 2 and 3, of Practical Lessons in Tropical Agriculture, by R. L. Clute, of the Philippine Islands. Book 2 discusses the importance of agriculture, the farm as a place of business and as a home, farm implements and their use, and preventing losses on the farm; it continues the study of the principles of agriculture begun in Book 1 (E.S.R. XXXIII, p. 397), and considers the application of these principles in the growing of field crops important in the Philippines, including rice, coco-nuts, hemp, sugar-cane, corn, tobacco and other crops. Each chapter includes practical exercises. In Book 3 the author discusses some of the more important fodder crops and deals largely with the management of live stock. Directions for organizing farming clubs are appended and suggestions to the teacher are included.

The question of determining the specific gravities of fixed oils in the tropics is dealt with in a note in *Experiment Station Record* (Vol. XXXV, No. 9). It is stated that owing to the fact that the dew point of the air is usually about 15.5° C. (59.9° F.) it is a difficult matter to determine the specific gravity at this temperature in the tropics, since moisture condenses on the outside of the apparatus used. A Westphal balance can be used if the oil is cooled to 15.5°, but the procedure is not convenient on account of moisture condensation on the surface of the oil and the platinum wire attached to the plummet. A convenient and rapid method in which the specific gravity is determined at the temperature of the air and then calculated for specific gravity at 15.5° is outlined in detail, and the calculations of the same explained.



SUGAR-CANE EXPERIMENTS IN THE LEEWARD ISLANDS, 1915-16.

The results of these experiments, conducted during the season 1915-16, have just been issued by the Imperial Department of Agriculture for the West Indies, in the form of a report dealing (1) with experiments with varieties of sugar-cane, and (2) with manurial experiments with sugar-cane. In regard to methods, the experimental work has consisted of a continuation of that which has been in progress for many years. Only the average results of the different series of trials of each variety of sugar-cane are given in the report; but this information is quite sufficient for general purposes, and as an indication of the general suitability in different parts of the Leeward Islands of one variety over another. Copies of the detailed results from the various experiment stations are forwarded to the individual planters in each district, while the completed records are open for inspection at the offices of the agricultural departments in Antigua and St. Kitts.

In regard to plant canes grown at Antigua during 1915-16, B.6308 heads the list with an average return of 32 tons per acre and 5,600 lb. of sucrose; it gave juice having an average saccharine richness of 2.01 lb. per gallon; 1915-16 was the third year in which this cane has done satisfactorily. The results indicate that it is well suited to Antigua conditions. The second place on the list is occupied by B.4596, which yielded 5,160 lb. of sucrose per acre. The present is the eighth year in which this variety has been experimentally cultivated, and during the entire period it has given uniformly satisfactory results, both under favourable and unfavourable seasonal conditions. Its continued satisfactory behaviour marks it out as one of the most valuable canes in Antigua, and this opinion is endorsed by planters with whom the variety has already gained considerable popularity. Other canes which have given satisfactory results are B.1528, B.3747, B.3922, B.3412, B.6388, B.4934, and B.6450.

In regard to the ratoon canes, the lead is taken by B.3747 which, as the mean of seven repetitions, gave an average return of 28.5 tons of cane per acre and 4,630 lb. of sucrose. It is to be remarked that on the present occasion this variety has come to the front in a striking manner both as a plant and as a ratoon. Other canes which have ratooned satisfactorily are B.3922, B.4596, B.3696 and B.109. These remarks refer to the past year's experiments. The mean returns from each variety grown as a ratoon cane during the past eight years show that B.3922 has come out on top, closely followed by B.4596. The first mentioned cane gave a mean return of 3,270 lb. of sucrose per acre.

In regard to the experiments with plant canes in St. Kitts, the results for the year under review indicate the premier position of B.4596. Other varieties which have done satisfactorily are D.216, D.109, D.625, and White Transparent. In regard to ratoon canes in St. Kitts, it is

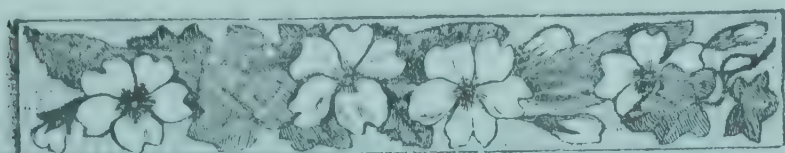
of interest to find that the first place in the returns for the year under review is occupied by A. 2, which has given an average yield of 35 tons of cane per acre and 7,660 lb. of sucrose per acre. This variety has done considerably better in point of average yields as a ratoon than as a plant. The varieties D.109, White Transparent, Sealy Seedling, B.4596, and D.116 have all done fairly well. During the year under review experimental plots were reaped in Nevis, as well as in St. Kitts; the first and second places are occupied in the results by D. 216 and D.1111. The former variety gave the high yield of 41.9 tons of cane per acre and 8,880 lb. of sucrose per acre. With such high yields it would look as if cane planting were highly profitable in Nevis, but it must be remembered that this is probably exceptional, being the result of highly favourable seasonal conditions. Probably the most reliable variety for Nevis is White Transparent.

As already stated, Part II of this report deals with manurial experiments. A general summary of the results achieved in manurial experiments in the Leeward Islands is given in this report, and figures are included to show the results of the new series of experiments introduced three years ago to test the value of artificial manures on plant canes, particularly in the absence of adequate quantities of pen manure. Experiments have also been designed to show the effect of manuring the same land year after year. The general results of the manurial experiments with sugar-cane, which have now been conducted in the Leeward Islands for nearly thirty years, are now fairly well known. It has been shown conclusively that where it is possible to supply pen manure at the rate of about 20 tons per acre, the use of artificial is unnecessary and unremunerative with plant canes. With ratoons, however, a dressing of quick-acting nitrogenous manure gives remunerative results, but the extent of the benefit depends largely upon the rainfall and the price of sugar. In a general way, where the season is good and the prices are high, manuring of any crop pays better than under unfavourable conditions. It has been shown that no benefit is to be expected from the application of phosphates and potash particularly the former. Experiments have been made with molasses as a manure but the results, as a whole, are not very encouraging.

Included in the report under review is a return showing the acreage under the different varieties of sugar-cane in Antigua and St. Kitts for the crops of 1916 and 1917. It is rather remarkable that in spite of the experimental results, the largest areas are still occupied by the older-introduced seedlings B. 147, Sealy Seedling, and White Transparent. There has, however, been a considerable decrease in the area under Sealy Seedling and White Transparent. There has been a considerable increase in the area under B.6450, B.4596, B.4507, in Antigua, and D.116 and A 2 in St. Kitts. It is to be noted that some 40 acres are still under Bourbon in Antigua, and over 100 acres were planted during the two years in Uba cane, which was introduced into Antigua for cultivation in localities unsuited to the more susceptible varieties.

An appendix to the report contains a table showing weights given by canes grown in the same fields as the experiment plots canes; also figures showing the exports of sugar from Antigua and St. Kitts in 1916.

Mr. S. C. Harland, B.Sc., Assistant Superintendent of Agriculture, St. Vincent, passed through Barbados on May 1 *en rou* for Canada on three months leave of absence.



PLANT DISEASES.

CITRUS DISEASES IN CUBA.

The difficulties which undoubtedly existed, to students of citrus literature, in comparing the citrus diseases of Florida and California with each other and with those of the West Indies, have been considerably lessened by the publication of a paper by H. S. Fawcett in which such a comparison is made as a result of studies in the States referred to and of a visit to Cuba and the Isle of Pines. (Bulletin 262, University of California Agricultural Experiment Station.) The author points out that in some cases different names are apparently being used for the same disease, and in other cases, the same name is being used for different diseases.

As being of most direct interest to West Indian growers, the author's account of the diseases met with in Cuba is here reproduced.

Mal di gomma or 'foot rot', as it typically occurs in Florida on old seedling orange trees, and a few cases of psorosis (California scaly bark) were seen. Diplodia gumming, due to *Diplodia natalensis*, in which fair sized branches were killed back was probably the most common of the gum diseases. It was seen in nearly every locality visited. This may possibly be the disease spoken of under 'twig gummosis' by W. T. Horne, in Bulletin 9 of the Cuban Experiment Station. Grapefruit (pomelo) trees seemed especially susceptible to this trouble. The same fungus was also found in nearly every locality in decaying pomelo fruits. A gum disease on the trunks of lemon trees was also fairly common, but it appeared to take a different form from either the *Pythiacystis* or *Botrytis* gummosis in California or foot rot in Florida. There appeared to be a large amount of exudation of gum with a small amount of killing of bark. The outer bark was killed ahead of the inner, somewhat like the *Botrytis* form, but the *Botrytis* fungus was not found in it.

The most serious form of gum disease in Cuba common on heavy soils, appeared to be the *Pythiacystis* gummosis. Beginning at the base of the trunk the bark was killed for some distance above the ground with the exudation of considerable gum. This form in most cases resembled closely the *Pythiacystis* (brown rot) gummosis, as it occurs in California on heavy soils. It is strongly suspected that this may be only one form of *mal di gomma*. The bark was killed rapidly clear through to the wood and had the characteristic odour of bark killed by *Pythiacystis*; from specimens of such bark from a grapefruit grove at Santiago de las Vegas, cultures of *Pythiacystis citrophthora* were obtained. As a culture of *Pythiacystis* was also obtained from similar specimens on the Isle of Pines and also at Palmetto, Florida, it would seem that this fungus is the causal agent in that particular type of gummosis there as well as in California.

Scab or Verrucosis (*Cladosporium citri*). Probably next in importance to the gum diseases, was scab, especially on grapefruit. During years when the moisture and growth conditions are favourable for infection by the scab fungus, a great deal of trouble is experienced from this disease. It attacks the young fruits, just as they are growing most rapidly. The off bloom or 'June bloom' fruit is most apt to be infected seriously. The leaves also may be contorted

and warped out of shape by it. The copper sprays (Bordeaux and ammoniacal copper carbonate) have been used successfully in preventing it, but the increase of scale insects due to killing off the fungus parasites of the insects is so rapid that many growers hesitate to spray with these copper fungicides. Lime sulphur is being tried out and is reported to have given good results.

Wither tip of Limes (*Gloeosporium Limetticolum*). Wither-tip of lime trees, the same as occurs in South Florida, appeared to be a prevalent and serious disease throughout the island. It blights the new growth as it comes out and interferes materially with the setting of young lime fruits. This is the disease which Mr. Roy Clausen of the University of California, determined to be due to a fungus resembling but apparently quite distinct from the *Colletotrichum gloeosporioides*, which is associated with wither-tip of other varieties of citrus in both Florida and California.

Blossom end rot of Persian limes. Wherever the Persian limes were found, there was a certain amount of a firm rot at the 'blossom' or styler end of the fruits. This appears to be the same as has been observed in Florida and in one case in California. It appears first as a whitish, sunken patch around the styler end. This patch remains firm and does not, as a rule, soften much as in some other kinds of decay. The cause is as yet unknown. It would appear to be due to an organism of some kind. A fungus resembling *Colletotrichum gloeosporioides* was found commonly in the spots, but was not determined to be the cause of the trouble.

Diplodia rot (*Diplodia natalensis*). A decay, especially of grapefruit, which begins at the stem end and slowly rots the fruit, was quite common. (The 'stem end rot' due to *Phomopsis citri* was not seen.) Cultures made from such fruits at various localities showed the Diplodia fungus to be present. This aside from blue molds appeared to be the most important decay. The same fungus has already been mentioned in connexion with the Diplodia gumming in branches. In some places considerable tear streaking, probably due to the wither-tip fungus, was also seen.

Leaf Spot, due to an Alga (*Mycoidea parasitica*). A certain amount of damage appears to be due to a species of alga attacking the leaves, producing a wart-like growth. This is not known to be present on citrus in either Florida or California. The damage from any one spot is negligible, but when the leaves become covered with spots they are weakened and fall off. It has not usually been considered serious enough to use any methods of prevention in Cuba. Any fungicide would probably prevent it.

Dark Greasy Spot ('Black Melanose'). Although the true Melanose appeared to be absent from Cuba and the Isle of Pines, a dark, greasy spot sometimes called in Florida 'Black Melanose', was very common, especially on grapefruit leaves. The writer's observation would lead him to say that this dark, greasy spot increases in prevalence and effect, as one passes from the northern to the southern part of Florida, and is even more prevalent in Cuba and the Isle of Pines. The spots have a dark, slightly raised, greasy appearance, suggestive of a mass of dark grease under a transparent epidermis. Their development on leaves in Cuba is much more definite than in most parts of Florida and would strongly suggest the effect of some organism. This would be suspected even more strongly since the discovery by Mr. H. E. Stevens in Florida, that the true Melanose is due to *Phomopsis citri*, the same fungus as causes stem-end rot.

LATERITE FORMATION IN SOILS.

The phenomenon of laterite formation has received attention in British Guiana, and the following article, reproduced from the *Agricultural Bulletin of the Federated Malay States*, will therefore serve to call further attention to the matter. Below will also be found an extract from Schimper's 'Plant Geography' dealing with the same subject:—

Laterite is the name given to a superficial rock formation characteristic of tropical countries. Although it has a very wide distribution, and is formed from very variable rock formations, it exhibits a remarkable uniformity in its characteristics. In composition it consists almost entirely of insoluble metallic oxides, and is characterized by an absence of combined silica.

It is the product to which all rocks in tropical countries in which the rainfall continuously exceeds the evaporation, tend to be ultimately converted. In this country most of the soils, except the recent alluvial coastal clays and certain sandstone formations, are lateritic in character to a greater or less degree, although for various reasons the ultimate pure laterite consisting of nothing but hydrated metallic oxides is practically never reached.

All rocks consist mainly of free silica (quartz), silica combined with oxides of iron, aluminium, magnesium, calcium, potash and soda, and sometimes calcium carbonates. A sandstone or quartzite may consist of practically nothing but pure silica, and a limestone of little but calcium carbonate. Such rocks cannot of course form laterite. The majority of rocks, however, do contain silica combined with varying proportions of metallic oxides. In temperate countries, when such rocks decompose, the oxides are removed in solution, silica combined with aluminium oxide and water remains. This is hydrated silicate of alumina or clay. In countries of high temperature this does not, however, occur; the oxides of soda, potash and calcium are removed as before, but the intense solvent action also results in the removal of the combined silica, leaving behind the insoluble oxides of aluminium and iron, which in combination with water form the product which we know as laterite. Neither pure clay nor pure laterite can be a fertile soil.

The importance of lateritic formation from an economic point of view, is that it results in the removal from the surface soil of those substances which are useful to the plant. This washing out which occurs in the F.M.S. lateritic hill soils is the reason for the poverty in chemical composition of these soils compared with those of temperate countries. Two factors are operative in retarding their entire exhaustion. Firstly the formation of secondary compounds rich in silica less easily decomposed than the original rock, and secondly, a factor which is very potent in this country, the absorption of the soluble substances by the humus formed from the dense tropical vegetation. The retention of the humus of the soil is therefore most important in maintaining the fertility of the soil. Yet when *bukit* land is opened up for cultivation, the humus is the first thing to disappear, being quickly decomposed and washed out from the bare unprotected soil. Where no cover crop is grown, and no measures are taken to prevent wash, not only is much of the surface soil removed in toto, but the process of laterization and therefore ultimate infertility vastly accelerated. It is not until the crop covers the ground that this process is retarded. To this cause may be attributed the well-known poverty of previously cultivated soils on which rubber is planted, and an explanation is offered of the good results which can be

obtained by the application of organic manures to these soils.

The question of the formation of lateritic soil in Java and Sumatra was recently fully dealt with in a 'Report on Certain Aspects of the Tea Industry of Java and Sumatra', by G. D. Hope, Scientific Officer to the Indian Tea Association.

The following information concerning the ecology of lateritic soils is taken from Schimper's 'Plant Geography':—

Physically, laterite is characterized by very low capacity for retaining water; in particular, old washed-out laterite, rich in coarse fragments, is very permeable. Being a soil poor in nutriment and drying rapidly, especially after its finely grained constituents have been washed out, *laterite affords a very unfavourable substratum for the existence of plants*. It is not yet known how far the large proportion of iron also affects the characteristic peculiarities of the vegetation.

Laterite, especially in its stony porous forms, induces in the forest a physiognomy which is characteristic both as regards its ecological features and its systematic composition, and which has been described by Brandis and Kurz in respect to Burma.

A tree characteristic of the laterite localities in that country is the eng, *Dipterocarpus tuberculatus*, which dominates the forest through its social habit, and distinguishes itself essentially from the other accompanying trees by the fact that it exhibits a normal growth in height, whereas the other trees are reduced to gnarled, more or less dwarfed, forms. Such forests are termed 'eng-forest' by Brandis and Kurz.

DRUGS AND SPICES ON THE LONDON MARKET.

The general character of the drug and spice markets during the month of February has shown no improvement since the date of our last report. The increasing shortage of imports, together with the depletion of office staffs and warehouse labour, and the German submarine menace, have done much to lessen the amount of products brought forward, and consequently the extent of business transactions. The general result has been the increase in prices, as will be seen from the following details. Amongst those articles which have commanded higher prices are ginger, arrowroot and sarsaparilla, while West Indian mace and lime oil have been lower. The following are some of the details.

NUTMEGS AND MACE.

At the spice auction on the 1st of the month as many as 393 packages of West Indian nutmegs were offered and 381 sold at steady rates for small and medium sizes. There was no demand for the larger sizes. At the same auction mace was also in good supply, 78 packages of West Indian being sold at the following rates: 1s. 10d. to 2s. for good pale, 1s. 5d. to 1s. 8d. for ordinary to fair, 1s. 3d. to 1s. 5d. for red, and 9d. to 1s. 2d. for broken.

Quite at the beginning of the month it was reported that quantities of kola nuts had been exported to the Continent, Good bright West Indian nuts, whole and halves, realized 6d. per lb. at the first spice auction. As many as 54 packages were offered and 34 disposed of. At the same sale 3 bags of Cassia Pistula pods were offered and disposed of at 40s. per cwt. for common wormy Dominica.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
March 8, 1917.

ARROWROOT—4½d. to 6d.
BALATA—Block, 3/3; Sheet, 3/11 to 3/11½.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, 78/- to 81/-;
Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£43.
COTTON—Fully Fine, no quotations; Floridas, no quotations;
West Indian Sea Island, no quotations.
FRUIT—Bananas, £18 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, 90/- to 115/-.
ISINGLASS—No quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations;
Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—5d.
RUBBER—Para, fine hard, 3/3; fine soft, no quotations;
Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., April
11, 1917.

CACAO—Caracas, 12½c. to 12¾c.; Grenada, 12c. to 12¼c.;
Trinidad, 11½c. to 12c.; Jamaica, 10½c. to 11¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$42.00 to
\$44.00; culls, \$28.00 to \$30.00.
COFFEE—Jamaica, 9½c. to 11½c. per lb.
GINGER—16½c. to 20c. per lb.
GOAT SKINS—Jamaica, \$1.20; Antigua and Barbados, \$1.10
to \$1.15; St. Thomas and St. Kitts, \$1.00 to \$1.10
per lb.
GRAPE FRUIT—Jamaica, \$1.25 to \$1.75.
LIMES—\$5.00 to \$6.50.
MACE—37c. to 42c. per lb.
NUTMEGS—21c. to 22c.
ORANGES—87½c. to \$1.50.
PIMENTO—5½c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 6.27c; Muscovados, 89°, 5.75c.;
Molasses, 89°, 5.25c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., February 23,
1917.

CACAO—Venezuelan, \$14.00 to \$14.25; Trinidad, \$17.28 to
\$17.76.
COCO-NUT OIL—\$1.45 per Imperial gallon.
COFFEE—Venezuelan, 12½c. to 14½c.
COPRA—\$7.25 per 100 lb.
DHAL—No quotations
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$8.40 to \$8.75; White, \$9.25 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., April 17,
1917

ARROWROOT—\$6.00 per 100 lb.
CACAO—\$13.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure,
no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$6.75.
PEAS, SPLIT—\$10.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$10.50; Patna, no quotations; Rangoon
no quotations.
SUGAR—Muscovado centrifugals, \$4.75.

British Guiana.—Messrs. WIETING & RICHTER; Messrs.
SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND- BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



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Binomial Grouping of Tropical Crops.

TROPICAL crops are usually studied indi-
vidually, but it seems that instructive and
suggestive ideas may arise from considering
them in the form of two great groups: (1) those crops
of which the produce is in the nature of fruit; and
(2) those crops of which the produce is derived from
vegetative growth. As examples of class 1 we may
mention cotton, cacao, limes, coco-nuts and coffee; as
examples of the second group, sugar-cane, rubber,
tobacco, and many of the starch-producing crops.

These two groups are separated from each other
by very definite characteristics. Contrasting them
first from the point of view of yield, we recognize some

very marked differences. First of all crops which
yield fruit produce are, on the whole, less dependable
than those which give vegetative produce. For instance,
in the West Indies every one knows that sugar-cane
is a more dependable crop than cotton; and again,
though we may hear of abnormally low yields of cacao,
we seldom or never hear the same in connexion with
rubber.

In the case of crops of which the produce is in the
nature of fruit, we see that yield is associated with the
fourth and last period in the annual life-history of the
plant. In the growth of a fruit-producing crop there
is first the germination or establishment period;
secondly, the vegetative period or period of develop-
ment; then the flowering period; and finally the fruiting
period. Yield depends largely upon the extent of
fruiting, and the extent of fruiting is chiefly determined
by the effect of external conditions upon the plant
during the three preceding periods named.

The most critical period is between flowering and
the actual gathering of the fruit. A short spell of
drought while the fruit is setting, or heavy rains or
wind at the time of flowering may lead to serious
reductions in yield, even though the plants themselves
may be in a highly vigorous state of growth. Cotton is
particularly fickle in this respect, it being impossible
to say what the yield will be until the lint has
actually been picked and safely stored away. It is
scarcely correct, however, to say the plant is fickle; the
crop itself may always be depended on to produce
the most it can; if it does not succeed it is due
to the external factors like unfavourable weather or
disease that intervene and mask the good biological
intentions of the plant.

In the case of crops which produce fruit therefore,
great caution must be exercised in measuring the

effects of treatment, like manuring, in terms of yield. Neglect to appreciate this principle is one of the reasons why the manurial experiments with cacao and cotton have often given such apparently inconclusive results.

As already intimated, yield in the case of the second group of crops which give vegetative produce is generally of a more constant character. Once the crop has become established there is no specially critical period. Nitrogenous manuring is generally essential, and general development, which is the thing aimed at, is almost entirely regulated by moisture conditions, and nitrogenous manures. In fact, the most important general difference between the two classes lies in the cumulative effect of nitrogenous manuring on yield in vegetative crops. And in connexion with yield, it will be realized that in the case of vegetative produce the collection of the material is not such a critical affair as it is with the more perishable produce of the fruit order. There are exceptions, as in the case of tobacco, but generally speaking this observation holds good.

An important way in which crops yielding vegetative produce differ from fruit-producing crops is in their composition. There is generally a marked preponderance of some constituent which gives to the crop its particular economic value. Thus in the sugar-cane there is a high percentage of sugar, in the yam a high percentage of starch, and in the rubber tree there are produced exceptional quantities of nitrogenous latex. Generally speaking crops yielding vegetative produce show a much wider variation in chemical composition compared with their wild prototypes. The difference in the case of fruit-producing crops is more a question of quality than one of proximate composition. Rubber, of course, is an exception, plantation and wild *Hevea* being very similar. But it must be remembered that the cultivation of rubber is a very recent introduction to tropical agriculture, and there is little doubt that in time seed selection will cause cultivated *Hevea* to exhibit marked differences from the tree growing in the wild state.

There is no general distinction between the two groups of tropical crops in regard to methods of propagation. Vegetative and sexual propagation is practised in both groups, though perhaps vegetative methods are used rather more in the second than in the first. In the case of crops producing fruit there appears to be no instance where the employment of seed is entirely absent from the method of propagation, for even in the case of grafted

citrus and cacao, seed has to be used in order to raise the stock. Similarly in the second group, the production of seedling sugar-canes implies fertilization and seed production in the first instance.

As regards pests and diseases, it would appear that crops yielding fruit products are in general more susceptible than crops yielding vegetative produce. Cotton is very subject to pests and diseases, the chief West Indian maladies being bacterial and internal boll diseases, and the principal pest the cotton worm. Generally speaking it is the fruit of these crops that is especially susceptible to disease. The fruits of most cultivated crops are so constituted as to afford an excellent medium for the growth of a parasitic organism: this is particularly well seen in the case of cacao and cotton. The vegetative tissues are not so easily infected, and they furnish a less congenial medium for the parasite's development.

There are other aspects in respect of which the two groups of tropical crops might be compared, but enough has been said to indicate the principal ways in which they tend to differ. It is important to note that in one respect—soil and climatic requirements—the classification into two groups breaks down. Each crop possesses a marked individuality in regard to soil and climate, and this is one of the principal reasons why in practice it is impossible to do other than study tropical crops individually. It is nevertheless suggestive sometimes to regard things from a new standpoint, and it is with this idea that we have attempted in this article to compare tropical crops on the basis of fruit and vegetative produce, respectively.

AREA UNDER DIFFERENT VARIETIES OF SUGAR-CANE IN ANTIGUA AND ST. KITTS.

For many years past it has been usual to include in the Report on Sugar-cane Experiments in the Leeward Islands a tabulated statement showing the area occupied by the different varieties of cane under cultivation in Antigua and St. Kitts for reaping in the season subsequent to that reported on.

A return of this description affords a means of following the manner in which the cultivation of the different varieties available for planting is being extended in the different cane-growing areas. It therefore constitutes a valuable adjunct to these experiments, since it offers a method of ascertaining indirectly how far the results of the experiments are borne out by the experience of planters.

Such a comparison has again been compiled in respect of the areas under cane varieties in Antigua and St. Kitts due for reaping in the crop of 1917.

Considering first of all the position in relation to Antigua, we find that the total area returned as under cultivation in canes on estates amounts to 9,960 acres in round numbers. This represents a decrease of 405 acres when compared with

the area cultivated during the preceding season. The decrease in question is mainly to be attributed to the extremely wet weather experienced towards the end of 1915, which materially hampered the operations of preparing the land.

The leading place in the return in point of area cultivated, is still occupied by the White Transparent variety, the total area to be reaped under this cane in the year 1917 amounting to 2,920 acres. This represents a further decrease of 500 acres over the area cultivated in 1916.

On previous occasions the history of the introduction of the White Transparent variety into Antigua has been summarized. The position which it has occupied for the past twenty years is that of the standard cane under cultivation, it having replaced in this capacity the Bourbon variety when the latter succumbed to disease in the middle nineties. Since 1900 the replacement of the White Transparent by seedling canes of more recent origin has been in progress.

In order to afford an indication of the rate at which this replacement has proceeded, it has been usual, in these compilations, to give a tabular comparison showing the percentage of the total area under cane cultivation occupied by varieties other than White Transparent and Bourbon, and this statement is again reproduced below with the addition of the figures for the year under review; in each case the returns are given to the nearest acre:—

	Total area cultivated, acres.	Area under varieties other than White Transparent and Bourbon, acres.	Percentage of total area under varieties other than White Transparent and Bourbon.
1907	8,879	1,902	21.4
1908	9,811	2,579	26.3
1909	9,554	2,379	24.9
1910	9,717	2,644	27.2
1911	9,618	3,371	35.0
1912	10,261	4,550	44.4
1913	10,041	5,537	55.1
1914	10,060	6,296	62.6
1915	9,661	6,195	64.1
1916	10,369	6,918	67.0
1917	9,964	7,044	70.7

It will be seen that the percentage of the total area cultivated in canes other than the White Transparent and Bourbon shows a further increase amounting to 3.7 per cent.

It may again be pointed out that the White Transparent cane is apparently not well suited to the heavy soils of the central portion of the island, and here it has become almost entirely replaced by other varieties. On the limestone lands of the northern and eastern area the variety does well, and is also a good cane from the point of view of the muscovado sugar manufacturer. Since the muscovado industry is now almost entirely confined to the eastern district, for reasons given, the variety continues to maintain its popularity.

After the White Transparent the largest area is occupied by B.147, under which cane 1,598 acres have been planted. This variety has attained considerable popularity in the more central parts of the limestone district where it gives good returns; it is not suited to the heavy lands of the central portion of the island. At the present time the bulk of the lands in the limestone area are planted under White Transparent and B.147.

The third largest acreage is occupied by Sealy Seedling, under which cane 1,490 acres are cultivated. This cane is especially popular as a variety well suited to the heavy lands of the Central plain. B. 6450 comes fourth with 1,055 acres; this cane also appears to be better suited to the heavy lands.

B. 4596 occupies 655 acres and is steadily increasing in popularity. B. 4507 occupies 555 acres; it is regarded by planters as similar in character to B. 147, and is cultivated under conditions suitable to that variety. D.109 is being grown on 351 acres mostly in the limestone area; the popularity of this variety is on the wane owing to its apparent susceptibility to root disease under Antigua conditions.

B.3412 is responsible for 303 acres; it closely resembles Sealy Seedling and is planted alternatively to that variety on the heavy lands of the island.

B.3922 occupies 191 acres and is increasing markedly in popularity.

With reference to St. Kitts, we find that the total area under cultivation is very nearly the same as that of the previous year, a decrease on the total area cultivated of only 46 acres being seen.

B. 147 continues to occupy the premier position, having been grown on 3,645 acres; this is virtually identical with the area cultivated last year. White Transparent has been cultivated on 2,698 acres, this being a decrease of 194 acres compared with 1916.

B.208 has continued to lose in popularity, and this year it was only grown on 94 acres. This variety at one time was very largely grown in St. Kitts, but the tendency which it has evinced in recent years to break down under the influence of root disease has led to its wholesale abandonment by planters. With this cause must also be coupled the fact that while the cane is particularly rich in sucrose, it does not give, even under the most favourable conditions, such heavy returns of cane per acre as some of the other seedlings. With the spread of the Central Factory system, the demand is for cane varieties which 'weigh well', and this has no doubt been a further contributing cause to the abandonment of the variety.

The returns, as a whole, show that there is greater inclination in St. Kitts at the present time to try the newer varieties on a field scale than has before been shown.

A New School-Book dealing with Farm

Pests.—The title of a school-book recently issued by the Macmillan Company, New York, is 'Farm Spies: How the Boys Investigated Field Crop Insects'. *Nature* states that it consists of a collection of brightly written, well-illustrated 'story-articles' on various common injurious insects of North America, designed to catch the attention and enlist the sympathies of pupils who possess no knowledge of economic entomology. Among the pests described are the cotton boll weevil and root louse, clinch bugs, grasshoppers, and the black corn weevil. The life-history and habits of the insects are drawn out by conversations between farmers and entomologists, and the farmers' boys are naturally enlisted in the work of destroying the ravagers of crops. It is stated that points in the breeding and feeding habits that bear on farm practice are often cleverly emphasized, and with the exception that one or two passages in this book are rather far fetched and inaccurate so as to be neither good science nor good fiction, this volume is one to be recommended to the consideration of those engaged in the teaching of nature study and elementary entomology.

SEED SELECTION IN THE CULTIVATION OF HEVEA RUBBER.

The attention of Messrs. Clayton Beadle, and H. T. Stevens, was recently drawn by the Director of the Royal Botanic Gardens, Kew, to the probable importance of seed selection in the cultivation of *Hevea brasiliensis*. He pointed out the large increase in the yield of alkaloids from cinchona bark which has been obtained as the result of seed selection, and suggested that important results might similarly be obtained in the cultivation of *Hevea brasiliensis*.

In June last they addressed a letter on this subject to the British Rubber Growers' Association, which has been submitted to Messrs. Morgan, Marsden and Reeve, the Association's resident scientific officers in the East. Below is given the substance of their original letter, together with a digest of the views of the Association's Experts, reproduced from the *Kew Bulletin* (No. 1 of 1917):—

In the cultivation of cinchona the yield of quinine from the bark has been raised from about 3 per cent. to 7 per cent. or more as the result of planting from the seed of trees whose bark yielded a high percentage of alkaloids. Can a similar method of seed selection be applied to increase the yield of rubber?

The matter, however, is not so simple in the case of Para rubber as in the case of cinchona. In the latter, the analysis of the bark reveals the percentage of alkaloids, but in the case of Para rubber it would be necessary to keep daily records of the yields of individual trees over some considerable period before it could be said with certainty whether the trees were good or poor milkers. Work of this nature would have to be undertaken as a preliminary to seed selection, as there seems to be some doubt as to how far trees fluctuate in their yields over relatively long periods. We were informed by one planter of experience that a tree which was yielding poorly might be yielding well in a few months' time, and similarly, trees which appeared to be yielding large quantities of latex might, in the course of a few months, be found to be yielding quite small quantities. We have not had an opportunity of obtaining figures over a sufficiently long period.

Having ascertained definitely that trees vary in yield, it will then be necessary to devise means for selecting seeds from good milkers and avoiding those from poor milkers. This matter is more difficult in the case of a rubber tree than in the case of cinchona. The cinchona produces a large number of small seeds, and consequently there is no difficulty in obtaining ample seed from a few trees, sufficient for planting up large areas. The bark gives a good yield of alkaloids when the tree is four years old, and although the percentage yield increases slowly over the next few years, the increase is small and regular, so that an examination of the bark of four-year-old trees is sufficient to determine their value as producers of alkaloids. On the other hand, *Hevea* produces a relatively small number of large seeds. Moreover, the bursting of the capsule by which these seeds become scattered makes it practically impossible to collect seeds from any particular tree*. There is also the question of cross-fertilization, as, even if the seeds be taken from good milkers, they may have been pollinated from trees which are poor milkers.

The points which require elucidation are:—

1. To ascertain if trees can be classified as good and poor milkers.

2. To ascertain which trees are good milkers.
3. To collect seeds from particular trees.
4. To avoid cross-fertilization between good and poor milkers.
5. Assuming that both male and female elements be derived from good milkers, there would probably be poor milkers among the ancestry. This would produce throw-backs, which might necessitate selection over another generation.

The necessary procedure would appear to be either:—

(a) To plant up a small area surrounded by jungle so as to isolate the trees in the area from those of the plantation, or:—

(b) To select a small area on an estate which is separate from other parts of the estate, and proceed to keep a record of the daily yields of the dry rubber from the trees of this area. As it becomes apparent that certain of these trees are poor milkers, they should be cut out until eventually the trees on this area consist of good milkers only.

If, as under (a), the trees have to be planted up on a fresh area, it will be seven or eight years before the poor milkers can be eradicated. If, however, an area already planted up should be found sufficiently isolated from the main part of the plantation to prevent the possibility of cross-fertilization, a couple of years would probably suffice to ascertain which are the poor milkers and to cut them out.

The seeds now produced in this area will be entirely from good milkers. They will produce trees, the majority of which will be good milkers, although a few of them, in accordance with (5), may be throw-backs, and consequently poor milkers. However, the seeds from this area should be a vast improvement on seeds collected at random on an estate. Having carried the procedure so far, it would be well worth while to make a further selection by planting up a new area separated by a broad jungle belt from other *Hevea* trees, and again to proceed regularly to record the yields, eventually cutting out the poor milkers that will probably be found among them. In this manner seeds will be available which should produce practically nothing but good milkers.

There is, perhaps, an alternative to the first part of the procedure we have outlined, namely, the propagation of trees by means of cuttings. This is possible, and if found practicable, the small area to be planted up for seed production could be furnished with good milkers grown directly from cuttings from the best milkers on the plantation.

The preliminary work carried out to distinguish between good and poor milkers may result by some simpler means being discovered by which either may be recognized. The investigation would be well worth undertaking from this point of view alone, as it would be of much benefit by enabling poor milkers to be cut out in the process of thinning out.

It should also be noted that deterioration in latex yields from newly-planted areas as compared with older areas is not only possible but, regarded from some standpoints, even probable. Thus, it is found that the cinchona trees which yield the smallest proportion of alkaloids from their bark produce abundance of seed, while exactly those trees which give the highest percentage of alkaloids are shy of fruiting. If it is possible to draw the parallel conclusion in the case of rubber trees, it follows that the present method of seed selection must result in a gradual deterioration of the rubber-yielding capacity of the tree for, by taking the seeds at random, a larger proportion of seeds from the prolific fruiting trees will be obtained, and these trees are just those which may be the poorest milkers.

*This difficulty might be overcome by cutting off seed-bearing branches just before the seed is fully ripe.

Having now reviewed the matter, we will consider the various points in the order in which they have been raised:—

(1) To ascertain if there is an appreciable variation in the yields of individual trees over long periods. Messrs. Morgan and Marsden are agreed that no attempt has been made to obtain reliable data as to the variation in yield of latex and rubber from individual trees, nor is anything known for certain as to the regularity in yield over a long period. Mr. Morgan writes: 'All planters are fairly sure that some trees are better yielders than others at all times,' but also agrees that 'yields may fluctuate.' Mr. Marsden is also of the opinion that certain trees 'do yield well consistently whilst from others the flow is always scanty.' Both Messrs. Morgan and Marsden draw attention to the occasional heavy yields from individual trees and suggest that such yields may be due to disease, especially canker, which according to Mr. Marsden, in the early stages of attack stimulates the latex flow. In any series of experiments it is therefore necessary to examine the trees carefully to see that they are healthy.

(2) It being admitted that a variation exists to determine how a classification of good and poor milkers can be made, Mr. Marsden states that good milking trees are known, but that for strict work it would be best to take the quantity and quality of latex figures for at least a year. It is certain that planters believe they can distinguish between good and poor milkers as on this depends the selection of trees in thinning out. Mr. Marsden states that good milkers are characterized by '(1) fewness of seed pods, and (2) late wintering.' If this be so, there would appear to exist the same relationship between yields of rubber and seed in *Hevea* as has been found to exist between yields of alkaloid and seed in *cinchona*, and the same conclusion must apply, that is to say, with the present haphazard system there will be a tendency for the rubber-yielding capacity of the tree to diminish, but that by careful seed selection, it should be possible to raise the rubber-yielding capacity considerably above the present average level.

Mr. Morgan also refers to trees with a smooth bark of a pink shade which are said to yield better than trees with ordinary bark. These trees are found growing in patches.

(3) The collection of seeds from particular trees. Mr. Marsden considers that this might be done by putting bird netting over the capsules on one or two branches. Owing to the prevalence of pod disease (due to *Phytophthora Faberi*, see later) in Ceylon, it has been impossible to collect really healthy seeds during the last few years. This disease could be kept in check by continuous spraying over a small area intended for seed collection.

With further reference to the question of seed selection, Mr. Reeve has written the following report on the two points raised, i.e.—

(4) To avoid cross-fertilization.

(5) Assuming that both male and female elements be derived from good milkers, there would probably be poor milkers among the ancestry. This would produce throwbacks in accordance with Mendel's law which might necessitate selection over another generation.

(4) To avoid cross-fertilization.—This difficulty could be overcome by taking cuttings in the first generation. A tree known as a good milker could be lopped and the cutting planted in some out-of-the-way place away from other rubber trees, preferably with a belt of jungle around. From these cuttings, seeds would have to be saved and planted. Allowing five to six years in Ceylon for the trees to come

into bearing, the good milkers could be picked from the bad and all the poor ones cut out. It would be necessary then to obtain seeds from the best milkers and plant separate plots from each tree's seed. When these plots come into bearing that with the least number of poor milkers could be taken as the purest strain, and from this plot after cutting out poor milkers the seed could be saved, knowing that such seed will give, on an average, 50 to 60 per cent., perhaps more, of good milkers. New areas would need to be planted fairly thickly, and all poor milkers could then be cut out leaving, say, 100 trees per acre known to be good milkers.

Re the point raised as to Mendelism. Is it definitely known that the property of yielding an excessive quantity of latex is capable of inheritance as a Mendelian character? If this were so the establishment of a pure race of good milkers would be comparatively simple. Consider the simplest case of Mendelian inheritance, i.e., a cross between a pure-bred good milker and a pure-bred bad one. The first generation would be good or poor milkers according to the dominance of the latex-giving characteristic, i.e., if the good milker were dominant, a hybrid of fairly good milkers would result. From the impure hybrids on fertilization pure strains and hybrids would result, and it would be necessary to pick out the pure strains and breed from them.

Probably nothing so simple would occur, and, as Dr. Stevens suggests, there would almost certainly be a certain amount of bad milking strain in the ancestry, which would have to be eliminated by breeding.

Even if the good milking characteristic did not follow Mendel's law, it would probably be an inheritable fluctuation which by selection could be improved.

Rubber trees might also have been selected from a known good milker giving, say, 8 lb. dry rubber per annum at twelve years old with the average yield per tree at 6 lb. per annum, and a breed of rubber trees could have been obtained giving, on an average, say, 7½ lb. per tree per annum, thus increasing yields 25 per cent. Such a procedure would have been the correct one, and a fairly pure strain of good yields could have been obtained in any twenty years starting from the good yielding tree in bearing. Such experiments could have been carried on indefinitely until a pure strain of good yielders were obtained.

Such a procedure is impossible now, and all that can be done is to select seeds from good yielders; if fresh planting is to be done, plant thickly and thin out poor yielders, where necessary. Taking a widely planted area, say sixty trees per acre, I think fully 75 per cent. of the seeds would be fertilized from the pollen of the seed bearer, and only about 25 per cent. cross-fertilized from other trees, since an insect once it arrives at a tree stays, and does not give itself an unnecessary amount of flying. Such an area of older trees with all bad milkers thinned out would give a fairly pure strain of good milkers.

Such a seed-bearing area would, however, need continuous spraying during the S. W. monsoon in order to keep it free from attacks of pod disease (*Phytophthora Faberi*)*. The ordinary rubber areas are full of this disease, and I do not think more than 1 per cent. of the seeds can be considered as good and plump, and fit for planting. It is the exception in this district to pick up a really good seed when walking round an estate. Naturally, isolation in jungle would partially remedy this, in that spores would be filtered by the jungle, and with about one or two sprayings the area could be kept healthy.

*This refers to Ceylon.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs Wolstenholme and Holland, of Liverpool, write as follows, under date April 16, 1917, with reference to the sales of West Indian Sea Island cotton:—

There is still a good enquiry for West Indian Sea Island cotton, with sales of ordinary St. Vincent at generally 40d. to 42d.

Quotations are raised a further 2d. per lb.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ending April 21, 1917, is as follows:—

ISLANDS. This crop having been all disposed of, there being absolutely no stock unsold, the market is closed, consequently quotations are omitted.

GEORGIAS AND FLORIDAS. The market continues strong with general demand on account of the Northern Mills. The very limited offerings, consisting largely of the lower grades, are very firmly held at irregular prices, ranging from Common at 62c. to Extra Choice and Fancy at 70c.

A lot of 235 bales classing

50 bales Choice and Extra Choice,	} were sold at 62c.
75 „ Extra Fine,	
70 „ Fine,	
40 „ Common Blues,	

And Extra Choice to Fancy were held at 68c. to 70c., at which some limited sales have been made.

The unsold stock in Savannah is estimated at about 1,500 bales, which for the time is firmly held on a basis of:—

Extra Choice to Fancy	68c. to 70c. = 70c. to 72c. landed.
Choice	66c. = 68c.

These extreme prices represent the present views of the holders of the limited unsold stock, but this advance has been paid only for a few small lots of the better grades.

The exports from Savannah for the week have been, to Barcelona 53 bales, Northern Mills 384 bales, Southern Mills 62 bales, and from Jacksonville to Northern Mills 300 bales.

In February last, *West Africa* made its bow to the public—a weekly paper devoted entirely to West Africa. The contents of the first number were varied and interesting. A paper which presents its arguments in a clear and forcible manner will have an influence on public opinion in the colonies, to say nothing of the effect it may have on the policy of administrators. Both in England and on the Coast there is good opening for a chronicle of West African news, and if matters, as the *Colonial Journal* says, are well ventilated in a reasonable manner, it will be of considerable advantage to all concerned.

THE WORLD'S SUPPLY OF CEREALS.

There is no more important subject at the present time than the world's supply of cereals. It is a very complicated subject and one which affects countries where cereals are largely produced and countries where agriculture is devoted to other lines of production. At the present time the very disturbed state of affairs resulting from the war has enormously added to the complexity of the situation, and it becomes a matter of extreme importance to consider what the position is likely to be next year, and in years to come.

A valuable step in this direction has been taken by the International Institute of Agriculture, Rome, whose Bureau of Statistics has recently issued a study of the yield, trade, consumption and prices, and rates of ocean freight, up to the latest time that the collection of data has rendered possible. In the opening chapters to this publication consideration is given to the methods employed in making this statistical study, and an interesting résumé is given in regard to the factors influencing at the present time production and consumption. Naturally military action is responsible for important factors, as for instance, legislative action tending to increase production and economise consumption, also blockades and the loss and diversion of shipping. In regard to legislation, it is shown that action was taken much earlier in Germany and Austria-Hungary with a view to ensuring a national supply of cereals than amongst the allied countries. This was no doubt rendered necessary by the blockade established since the beginning of the war. The increased activity of enemy submarines has now tended to place the position of the allies upon the same level as that of the Central Powers, and one of the principal objects of the United States at the present time is to increase its supply of cereals and arrange for the transportation of its surplus to other centres.

The information in the publication under notice is not brought so far up-to-date as the matters last referred to, but it indicates that these and other changes in the military and political situations of the world must be carefully looked into if the supply of cereals is to be maintained, and what is more important if the distribution of the surplus is to be properly effected.

The résumé to the publication states: 'It is useless to ignore the fact that the world's wheat crop of 1916 and 1916-17 is unquestionably bad as compared with the crop of 1915 and 1915-16. It shows, in fact, a deficiency of more than a $\frac{1}{4}$ in this contrast. It is also poor when compared with the average yield of the five years, 1911-15 and 1911-12 to 1915-16 as it indicates a deficiency of $\frac{1}{8}$ in this connexion.'

In regard to maize, it is stated that this cereal shows 'the most unfavourable statement among the five cereals (wheat, rye, barley, oats and maize), for the year will work out with a deficiency of 62,000,000 quintals, in spite of the reserves from the previous crop being 55,000,000 quintals.'

Altogether the evidence collected and examined by the International Institute of Agriculture tends to show that in the near future the supply of cereals is likely to be serious unless better seasons are experienced, and unless changes occur to facilitate the better distribution of the surpluses from different countries. It will be interesting to see what is going to happen to the Russian surplus.

Two interesting botanical papers appear in the *Philippine Journal of Science*, Section C, Botany, Vol. XI, No. 4: one on natural selection and the dispersal of species, by Dean Copeland, and another on Hawaiian ferns, by the same author.

SUGAR INDUSTRY.

CENTRAL FACTORIES FOR JAMAICA.

A statement of the proposals submitted by Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, to the Government of Jamaica in regard to the establishment of Central Sugar Factories in that Colony has recently been received, and the following is an account of the principal points involved.

For some little time a strong desire has made itself manifest in Jamaica, as in other parts of the West Indies, for the development of the sugar industry. Under modern conditions, however, it is necessary if effect be given to this desire, to consider the introduction of thoroughly up-to-date and progressive measures, which involves the establishment of modern factories of considerable size, linked up with comparatively large areas producing sugar-cane. To ensure the success of a modern factory it is essential to have contracts for the performance of various services extending over long periods of time; these are more likely to be entered into with confidence when the Government is actively concerned. In accordance with this idea the proposals put forward in Jamaica have involved the principles of direct Government financial aid and co-operation.

The preliminary paragraphs outlining the proposals describe the relationship that it is desirable to establish between the Government, the contracting planters and the Board of Directors. The principal idea is that a limited liability company should be formed to operate the factory, financed by Government Debentures, and controlled by Directors appointed by the Government and by the Associated Contracting Planters. The following is a précis of the proposals put forward by Sir Francis Watts, and approved by the Governor and Legislative Council on April 5, 1917:—

It is sought through the medium of the accompanying form of Agreement [not reproduced here] to give effect to the proposals that the Government may, on business lines, afford assistance in developing the Sugar Industry of Jamaica.

The Agreement provides that the cane growers of a district shall associate themselves together under contract to cultivate a sufficient acreage in sugar-canes to keep a sugar factory employed and shall form a Company, the Shares of which will be assigned to the Government, to be held by the Government as security for the Government interest in the Factory, and that on this being done the Government will advance to the Company a sum agreed upon for the erection and working of the Factory.

This sum will be secured by Debentures of the Company bearing interest at six per cent. per annum and redeemable by a Sinking Fund of four per cent. whereby it is calculated that the Debentures may be redeemed in about twenty years, but they may be redeemed earlier.

During such time as any Debentures are outstanding the Government shall, in addition to the interest on the Debentures, receive one half of the net profits of the Factory, and for five years after the Debentures are redeemed the Government shall receive one fourth of the profits of the Factory.

At the expiration of that time the Government is to transfer the Shares back to the Company, and the Company is to distribute them to the cane growers, who have entered into contracts under this Agreement, in proportion to the canes delivered by each contractor to the Factory. The Shares are only to be held by those who continue to grow canes for the Factory. The Shares are not to receive

any interest and only entitle their holders to vote in connexion with the election of Directors or in other similar matters.

The cane growers bind themselves by this agreement to maintain in cultivation in sugar-canes the acreages stipulated by each, thus ensuring an adequate supply of canes for the Factory.

Provision is made for safeguarding the interest of the Factory from default of the cane growers.

The cane grower binds himself to supply canes to the Factory for the whole period above mentioned during which the Government interest remains in the Factory, including the five years during which the Government receives one-fourth of the profits. The provisions of the agreement and of the Central Factories Law of 1902 afford security to the Company, and thus to the Government, for the proper performance of the contract.

The contracting cane grower is to receive for his canes the local value of Five Pounds of grey crystal sugar of 96° test for each hundred pounds of canes delivered, this is equivalent to 1/ per ton of cane for each one pound per ton, in local value of sugar. Thus if sugar is worth £12 per ton the canes are paid for at the rate of 12/ per ton.

In addition to this payment the contracting cane grower is to receive his proportion of one half of the profits of the Factory until such time as the Debentures are paid off, after which, for a period of five years, he is to receive his proportion of three-fourths of the profits. Finally, after this last named period, he is to receive his proportion of the whole of the profits.

Until the interest of the Government in the Factory ceases the management of the Company is to be entrusted to Directors, one half of whom are to be nominated by the Government and the other half by the contracting cane growers.

THE SUGAR INDUSTRY IN THE UNITED PROVINCES.

The cultivation of the sugar-cane in this part of India presents very different problems to those encountered in the West Indies. In India, sugar-cane occupies the land only about one-half the time that it does in the West Indies, and after the crop is established it has to carry through a period of drought that is by no means conducive to high yields. Very often dry weather and the attack of white ants seriously interfere with germination, and this is often one of the causes of the low tonnage per acre. Provided irrigation can be carried on during the hot or dry period, the climatic conditions in the United Provinces are otherwise favourable in a general way for excellent growth.

The reason for the small return of sugar seems to lie more in the preparation of the sugar than in the composition of the cane or the milling. The principal loss occurs during boiling owing to the fact that no care is taken to avoid acidity.

The great difficulty that has to be faced in making any attempt to organize cane growing on the central factory basis is that the fields of cane are so small and scattered. Moreover, the cultivator cannot afford to devote all his attention to sugar-cane: he has to grow food crops, and this of necessity means a limited amount of production.

Considering the fact that most of the sugar-cane soils have been continuously cropped for hundreds of generations without adequate manuring, it is surprising that growers are able to obtain the yields they do under the circumstances.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

In the editorial to this issue tropical crops are considered in two groups—those whose produce is in the nature of fruit; and those whose produce is derived from vegetative growth.

On page 148 will be found an interesting article on seed selection in the cultivation of Hevea rubber.

The precarious state of the world's supply of cereals and its distribution is brought out in an article on page 150.

Insect Notes, on page 154, deal with insect pests in Barbados in 1915-16, also with the pink boll worm in Brazil. Plant Diseases consist of two short articles concerning diseases of the sugar-cane in the West Indies.

'Curare' or 'Ourali' Poison.

Particular interest centres around the vegetable poison known as 'Curare' on account of recent attempts to poison the British Prime Minister by means of it. 'Curare', which is only one of its many native synonyms, is an extract from the bark of *Strychnos toxifera*, Schomb. (N. O. Loganiaceae) mixed with other, possibly inert, substances. It is prepared as an arrow poison by tribes of Indians in British Guiana, French Guiana, Venezuela, northern Brazil—in fact throughout the whole of north of South America, and is most powerfully toxic in its effects. According to the *British Pharmaceutical Codex*, the constituents and strength of the drug vary in different specimens. The chief poisonous principle is the alkaloid curarine, $C_{19}H_{26}N_2O$, which has been obtained as a yellowish-brown powder with a bitter taste. Its action in the human system is to paralyse the motor nerve-endings in striped (or voluntary) muscle, death occurring from respiratory failure. In larger doses it also paralyses the nerve cells. Curare is almost inert when taken by the mouth, probably owing to its rapid excretion and to the destructive action of the gastric juice. It is used medicinally, by hypodermic injection, in the treatment of tetanus, hydrophobia, and strychnine poisoning, but the dose is never pushed to the stage of motor paralysis.

Some interesting details regarding the poison and its manufacture are given in the *West India Committee Circular* (March 8, 1917). Before it is ready for use, the concoction, which is usually of a jelly-like consistency, is left in the open for a few days. As to its effectiveness, a fowl slightly pricked with a dart on which the poison had been smeared ceased to live (for that is the only way to describe the apparent symptoms of the poison) in about six minutes.

Berseem or Egyptian Clover.

The crops grown in Egypt are very various, but the three kinds which constitute the basis of Egyptian agriculture are clover, corn and cotton. Corn constitutes the food of the people, and consists of both maize and wheat. Although in the outside world cotton is the best-known Egyptian crop, it is nevertheless a side issue—the surplus crop made possible by a fertile soil, and one which is sold out of the country thus constituting the principal source of national income. According to Dr. Lawrence Balls, the primary source of wealth in Egypt is clover. This crop is grown to increase the nitrogen and humus content of the soil, and to serve as a green fodder for animals. In Egypt it is known as Berseem. Quite recently it has been suggested that this Egyptian clover, which is peculiar to Egypt, might succeed in the West Indies. While the suggestion possesses points of interest, it would not seem that the introduction of Egyptian clover, even if it proved successful, is really required, on account of the large variety of green dressing and fodder crops already under cultivation in these islands. However, the fact that an

average cutting of clover in Egypt produces about 8 tons per acre, which means that on good land the total crop may amount to 50 or even 60 tons of green fodder from an acre of land during seven months, makes this crop appear attractive, especially from the point of view of the stock owner. Furthermore its cultivation is of the simplest, but to produce the high yields mentioned above, irrigation would be required except in districts of adequate rainfall. The experience in the past has been that leguminous fodder crops are somewhat particular in respect of conditions of environment; thus even seed of alfalfa raised in Arabia would not produce a satisfactory crop in the West Indies. It would be of interest, however, to try this clover experimentally, and perhaps arrangements may be made to conduct such an experiment in one of the islands.

Further Note on Berseem.

Since the foregoing was written a recently issued Bulletin (No. 66) from the Agricultural Research Institute, Pusa, has been received dealing with berseem as a fodder crop for India. This Bulletin contains several additional facts to those mentioned above in regard to this clover crop in Egypt. It is stated that two to three months after sowing the crop is ready for the first cutting. After that the number of waterings required varies according to the soil. In Egypt, berseem is commonly grown in rotation with cotton; sometimes it is sown among standing cotton and when ready for the first cutting, is cut down with the cotton stalks. The best way to grow Egyptian clover would seem to be after maize, since this allows plenty of time during which to plough the land. In considering berseem as a possible West Indian crop, it must be borne in mind that both in Egypt and India the clover is a cold weather crop. As such in those two countries it is of great importance, and its place cannot be adequately filled by any other. It may be noted that berseem produces excellent hay, which is a matter of some importance. According to the *Agricultural Gazette of New South Wales*, berseem has been satisfactorily grown in that part of Australia. Undoubtedly its trial in the West Indies would be worth while on account of its great value as a fodder as distinct from a green dressing crop. As already intimated, berseem has also great powers in regard to the maintenance of the soil's supply of nitrogen.

Cotton and Fibre Papers in the 'West Indian Bulletin'.

Two scientific papers on the classification of West Indian Fibre-Agaves, and on the inheritance of the number of teeth in the bracts of species of cotton, appear in the recently issued number of the *West Indian*

Bulletin. The first paper should prove helpful to those concerned with the collection or distribution of sisal plants, and there are indications of increasing interest in this direction in some of the islands at the present time.

The paper on inheritance in cotton, by Mr. S. C. Harland, B.Sc., of St. Vincent, ends with the following conclusions:—

'It has been shown that different varieties of cotton are characterized by differences in the number of teeth in the bracts. It may be stated that frequency polygons of such different forms as those of Sea Island, St. Croix Native, Upland, and Cauto, imply differences in gametic composition in respect of the character.

'When crosses are made between types differing in the number of bract teeth, the F/1 in the case of two of the crosses showed complete dominance of the larger number of teeth, but in the third case the F/1 exhibits intensification, and has a larger number of teeth than either of the parents.

'Having regard to the fact that certain cottons are known to have bracts from which teeth are absent, it seems fairly clear that it is possible to get at least six homozygous types differing constantly in the number of teeth. Hence at least three factors may be concerned in the production of the tooth value of the cotton possessing the highest number.'

Breaking up Pasture for Sweet Potatoes.

In the issue of the *Agricultural News* for April 21, 1917, we published a short article explaining the difficulties attendant on the converting of pasture into arable cultivation, more particularly with reference to conditions in the British Isles. In the article it was prophesied that there would be a tendency to dig up West Indian pastures in answer to the call for the cultivation of a greater area of ground provisions. In certain places this is being done. Considerable areas of pasture are being forked up, and it is chiefly intended to plant sweet potatoes on these new areas.

In regard to the difficulties of obtaining a good tilth in this land, it must be remembered that sweet potatoes as a crop are not so particular as to tilth as crops grown from seed. However, the land must be weathered down into good heart by sun and rain. The following is what Mr. A. J. Brooks says regarding sweet potato culture in St. Lucia:—

'Much better results would be obtained if all the leaves were removed from the cuttings before being planted out. The banks as a rule are poorly made. The land being *scraped* rather than *dug*, is the chief cause of poor yields being obtained. To produce heavy yields of all root crops the land must be worked to a deep tilth to provide sufficient space for the tubers to swell. One deep broad bank would yield more potatoes than two shallow ones.'

Cultivators do well to note these facts, particularly where a hurried attempt is being made to convert pasture into arable land.



INSECT NOTES.

INSECT PESTS IN BARBADOS IN 1915-16.

The Report of the Barbados Department of Agriculture for the year ended March 31, 1916, has been published as a Supplement to the Barbados *Official Gazette* of April 16, 1917.

The portions of the above report which are concerned with insects will be dealt with in the following notes. The Superintendent of the Department, Mr. J. R. Bovell, refers to the establishment of the parasite of the brown hard back (*Phytalus smithi*) in Mauritius, while Mr. J. S. Dash, Assistant Superintendent, gives an account of the more important pests of sugar-cane and other cultivated crops.

TIPHIA PARALLELA IN MAURITIUS.

The brown hard back (*Phytalus smithi*) has been a serious pest of sugar-cane in Mauritius for several years, and the Government has been spending large sums annually in fighting it. Mr. F. A. Stockdale, Director of Agriculture in that island, has stated that for the year ended June 30, 1914, nearly 36,000,000 beetles had been caught and paid for, and in addition the planters had caught over 1,000,000, but in spite of all they were only just keeping the pest in check. Mr. Bovell publishes a report from M. d'Emmerez de Charmoy, Entomologist in Mauritius, stating that *Tiphia parallela* has become established in two distinct localities in that island.

It is of interest to note that the adult Tiphias were observed feeding on the nectaries of *Cordia interrupta*. Although the numbers of *Tiphia* in Mauritius are at present small, there is every reason to expect that this parasite, given suitable conditions will spread throughout the grub-infested area, since the supply of food is still apparently unlimited, in spite of the unceasing collections of *Phytalus* grubs and adults that are being made.

(In this connexion it may be mentioned that the parasitism of *Phytalus smithi* by *Tiphia parallela* was first discovered in Barbados in 1912 by Mr. W. Nowell, then Assistant Superintendent, and it was mainly through his efforts that a shipment of *Tiphia* material was subsequently made to Mauritius.)

SUGAR-CANE INSECTS.

There are three pests of sugar-cane which require the constant attention of planters in Barbados. These are the root borer (*Diaprepes abbreviatus*), the brown hard back (*Phytalus smithi*), and the moth borer (*Diatraea saccharalis*).

The root borer has for several years been most prevalent on many estates situated on the lower levels of the island, and does most damage in fields where no thorough system of crop rotation is practised. The recommendations for control given in former reports are again emphasized, namely, collection of adults and egg-masses, rotation of crops, and digging up of stumps in infested fields immediately after the reaping of the crop.

The brown hard back is apparently kept down by its parasite in some districts, but even in these localities it is always to be reckoned with as a potential pest, since it cannot be reasonably expected that *Tiphia* will keep it under complete control. There are other districts, however, where *Phytalus* apparently occurs without its parasite, and attempts to introduce *Tiphia* into these districts have not, so far been altogether successful. The beetles begin to appear at night about May or June and should then be collected and killed.

The moth borer is generally distributed without being a serious pest in any one locality, but taking it as a whole, this insect is probably not behind the above-mentioned pests in actual damage done to sugar-cane. Mr. Dash again urges the systematic collection of the egg-masses and preservation of the egg-parasites as measures of control, but these methods to be effective must be generally and systematically carried out.

Other pests of sugar-cane observed during the year are the mealy bugs *Pseudococcus calceolariae* and *P. sacchari*. Delphax was not noticed. This leaf-hopper is probably checked by its parasite *Anagrus flavescens*.

PESTS OF MISCELLANEOUS CROPS.

These were not as prevalent as usual. Mention is made of injury done to tomatoes by the larvae of a cut worm (*Prodenia dolichos*), which were found boring into the fruit. Scale insects were not as abundant as in the previous year. The scale fungus *Cephalosporium lecanii* is being cultivated and will be distributed as occasion demands.

THE PINK BOLL WORM IN BRAZIL.

In the *Agricultural News* of April 21, 1917, mention was made of the appearance of the pink boll worm in Mexico from Egypt, and of the danger to which the cotton-growing districts of the Americas and of the West Indies are now exposed. The following note taken from the *Journal of Economic Entomology* for April 1917, is given as an illustration of the importance of quarantine against injurious insects:—

Early in 1914 Mr. E. C. Green, an American engaged in the encouragement of cotton culture by the Brazilian Government, made a careful survey of the cotton belt of Brazil. He was looking especially for the boll weevil and the pink boll worm. Neither insect was found in the course of considerable travel and extensive examinations of seed. Late in 1916 Mr. Green made another trip over the same territory and found that the pink boll worm was generally and thoroughly established. The way in which the insect was introduced is clear. In 1913 the Brazilian Government agitated the cultivation of Egyptian cotton in that country. An agent was sent to Egypt and large quantities of seed were shipped to Brazil. No precautions were taken as to the seed obtained, and it was all admitted to Brazil without fumigation or other treatment. The Brazilian Government has inspectors located in every State capital. The seed was distributed to these inspectors and in turn by them to local representatives. This was probably as thorough a method of disseminating an insect as is possible. The Brazilian Government now realizes what has been done and various Senators seriously consider an enactment requiring the burning of all the cotton fields in the Republic.

A RECORD OF AVERAGE PRICES.

In the *Times Trade Supplement* [London] for April 1917, is given in diagrammatic form the fluctuations of the principal markets during the previous three months—January, February, and March. These include cotton, wool, prices of flax, hemp and jute; oil seeds and oil (soya) beans; butter and cheese; sugar; prices of feeding stuffs; meat prices; prices of breadstuffs; tea, coffee and cocoa prices—the fluctuations in each case being indicated by a chart. Of these commodities, those which may be regarded as of more direct interest in the West Indies are sugar, tea, coffee and cocoa.

As regards sugar, which had been under discussion more than any other staple during the past month, the chart shows an absolutely unbroken series of level lines throughout the three months. This article, as is well known, is under Government control, but it is pointed out that the Government control does not mean an unchanged price—the price of maize, for instance, within the month controlled, had been advanced half-a-crown per quarter;—consequently, there are other factors which have conduced to the maintenance of a uniform price for sugar during the three months under review: sufficient supply, for example, had throughout been forthcoming at an unadvanced price. Imports since January 1 have exceeded the home consumption by 325,000 cwt., and stocks have risen to 2,100,000 cwt.

The prices of tea, coffee and cocoa, on the other hand, show considerable fluctuation. During the month of January tea remained normal, but from February 2 and throughout that month the chart shows a steady rise to 160s. per cwt., at which figure the price remained normal to the end of March. Coffee remained normal up to the middle of February; then there appear to have been a steady rise to the end of that month, and fairly even normality from that point throughout the month of March. In the case of cocoa, there is evidence of a somewhat rapid rise shortly after the middle of January, at which point prices remained level until February 2, when there was a gradual and continuous rise throughout the month of February and up to the beginning of the last week in March, from which point the line remained level.

In regard to the fluctuations in these last three items, the following observations are made: 'We seem to be using tea at the rate of a million pounds weight daily, which is a moderate quantity. As we have also reduced our exports, things are not so bad, despite the fact that since January 1 we have received 19,000,000 lb. less than last season. The excitement at the grocers' shops has no correlative on the wholesale market. The price of common tea has receded a little from the advance induced by Government intervention in February, but owing to China tea being under bare quality, grades generally are maintained at a high price. As we apprehended, the uprush in common coffee was quietly stayed. Its sales are good; consumption barely an average. Fine coffee is also cheaper; it is a luxury and aristocratic drink of a class that is now economizing. Nor does it attract the munitioneer. Cocoa is dearer. The supply seems sufficient for current wants. As we go to press we hear that without price change, tea, coffee, and cocoa are all a trifle in buyers' favour.'

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., D.Sc., Imperial Commissioner of Agriculture for the West Indies, returned to Barbados on May 14, 1917, after an official visit to Jamaica in connexion with the establishment of a sugar industry in that Colony. Sir Francis Watts left Barbados for this visit on February 19.

GRENADA DEPARTMENT OF AGRICULTURE.

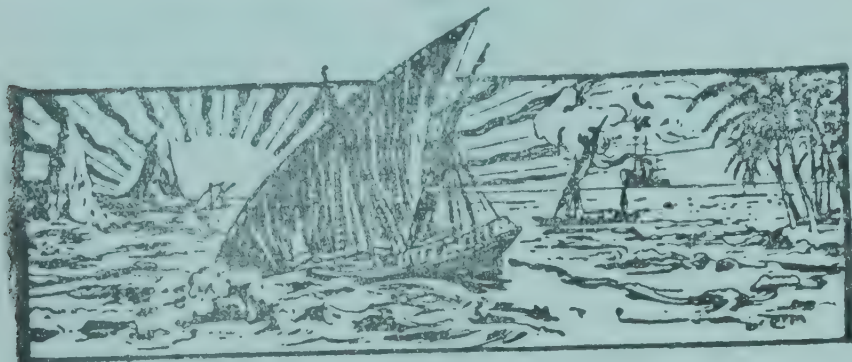
Some interesting items appear in the Progress Report on the work of the Grenada Department of Agriculture for the quarter ended March 31, 1917. Weekly observations on the prevalence of thrips, and the general conditions prevailing in selected fields on four cacao estates were commenced. There was also submitted a report on the results of a preliminary trial of *Sporotrichum globuliferum* in thrips control work. The results are stated to have been distinctly encouraging, and are said to justify the trial of this fungus under field conditions. The possibility of producing a local supply of the fungus for further experimental work is receiving attention, and the proposals for work in this connexion are in due course to be submitted to the Board of Agriculture for consideration.

Work in connexion with the storage of corn has been continued. Fumigation of the corn and germination tests have been carried out at intervals. Records of this work are being kept for publication on completion. The results up to the time of writing in regard to the control of weevils and grain moths, and preserving the vitality of the seed were satisfactory. Germination tests conducted on samples of seed from the bottom, middle and top of the bin, on March 27, gave an average viability percentage of 93. Arrangements for the local distribution of the seed are being made.

Work in the Botanic Gardens during the quarter has consisted in the usual routine work together with a good deal of special work connected with the raising of plants for distribution. Considerable activity has been shown in regard to the raising of lime seedlings, and the propagation of budded oranges and grafted mangoes has been continued. A large quantity of coco-nut plants has been raised and distributed. Particularly noticeable has been the large amount of beans and peas distributed for planting. The demand for seed of the horse bean (*Canavalia ensiformis*) exceeded the supply. Since the harvesting of the crop began over 1 ton of seed had been distributed.

Apart from special work in regard to pests and diseases, the above are the principal features of what may be described as the internal work of the Department for the quarter under review. In the country districts considerable activity has been shown by the instructors who have, in addition to doing general instruction work in the several parishes been active in working up the Prize-holdings competition for the coming year. Normal progress is reported in regard to land settlements. In regard to cotton, a competition for encouraging improvement in the cultivation of this crop in Carriacou has been started and favourable progress is reported up to date. The forestry inspection work in Grenada has been continued during the quarter, and it is hoped to complete it during the favourable weather prevailing at the time during which the present report was compiled.

A new book on drift seeds, entitled *Plants, Seeds and Currents in the West Indies and Azores*, by H. B. Guppy (Williams and Norgate, 25s. net) has recently been well reviewed in several publications. *The Times* refers to the exhaustiveness of the treatment of the subjects in this book as monumental, and the result as an indispensable authority for all future students of the subject. The Great Western Railway Company, in England, hopes that the West Indian seed drift will serve as an attraction to the Cornish shores on which it is cast. This little point indicates the extensive nature of the subject dealt with.



GLEANINGS.

A note in the *Experiment Station Record*, which refers to a Louisiana report, states: 'the polyphenol content of juices could be reduced by topping cane low, using tops for planting. This would result in a distinct improvement of the colour of juices.'

According to Items of Departmental Interest for April received from St. Kitts, there was considerable activity in the distribution of planting material for provision crops during the month. The distribution was as follows: 2,400 cassava cuttings, 600 sweet potato cuttings, 157 lb. of yams and 50 lb. of eddoes.

Information has also been received from St. Kitts to the effect that the acreage under cotton in that island and Nevis will be considerably increased this season on account of high prices. Where possible the seed has already been planted, and in some districts the young crop is looking very promising.

Australia continues to agitate for an extension in the cotton industry of that country, and it would appear that the principal reason is to obtain cotton waste for the production of explosives. A short time ago, according to the *Agricultural Gazette of New South Wales*, the following resolution was passed: 'That a Munitions Cotton League be now formed, to press forward the production of cotton in Australia, so that it may be available for the manufacture of munitions.'

According to data published by Mr. A. D. Shamel in the *Monthly Bulletin of the California State Commission of Horticulture* for February 1917, the factor of relative humidity is of as much, if not greater, importance in the storage of fruits than temperature. There are indications that a proper regulation of temperature and relative humidity may lead to the preservation of fruit for long periods of time without the necessity of refrigeration.

According to advices received from St. Kitts, the old cane crop is being rapidly reaped in that island, especially in the Central Factory districts. The juice is stated to be particularly good, and the returns are very satisfactory. It is reported that the young cane crop has felt the dry weather and the late planted fields are very backward. During the last few days previous to the time of writing showers had fallen which should help to improve matters considerably.

Notes which appear in the *Agricultural Gazette of New South Wales* for February 2 suggest points to teachers, which may also serve as a guide to farmers and farmers' sons, who wish to make observations of maize in order to familiarize themselves with various details that do not generally come under notice in the ordinary way. The directions given for a practical study of the different parts of the corn plant are excellent, and we strongly recommend the notes to the attention of West Indian teachers.

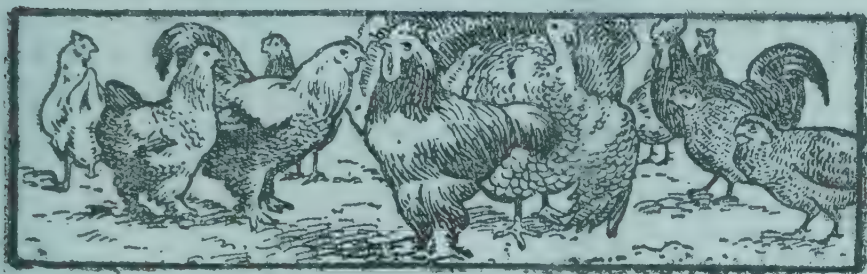
An interesting paper appears in the *Geographical Journal* for March 1917, on the Geography of the South American Railways. This article should prove of particular interest to British Guiana, since it deals largely with Brazilian railways, though the Argentine lines are equally well described together with those railways in the other Republics of South America. The paper, which is to be continued, is illustrated with several striking photographs including one of the cable hoists, Sao Paulo railway, Sao de Mer, Brazil.

In a note in *Nature* for February 8, 1917, reference is made in an appreciative way to the careful study made by Father C. B. Dawson, M.A., of that most remarkable bird, the Hoatzin (*Opisthocomus cristatus*). The results so far obtained are given in Father Dawson's 'Hand-list of the Birds of British Guiana'. It appears that in the case of the bird referred to, the mother feeds the young as young pigeons are fed. That is to say, the method is the same, the young abstracting its food by thrusting its head down the mother's throat.

Dr. E. J. Russell, writing in *Nature* on the scientific aspects of glass-house cultivation says that, 'in the case of cucumbers, phosphates in some circumstances actually depress the crop as has been noted elsewhere with cotton and sugar-cane.' This reference is doubtless made to West Indian experimental results, but it is very doubtful whether there is any conclusive evidence to show that phosphates have a depressing effect in the West Indies, though they have frequently been shown to be accompanied when used as a manure by pecuniary loss.

Reported in *Soil Science* for March 1917, are the results of an experiment showing some of the effects upon seeds of small applications of copper sulphate, sodium carbonate and sodium chloride to the soils in which the seeds are planted. The effect of copper sulphate upon corn did not show differences large enough to indicate whether this salt increases or decreases absorption when applied in small amounts. Small applications of copper sulphate increased the absorption of bean seeds. Small applications of sodium carbonate increased the weight of all kinds of seeds used in the experiments.

A copy has been received of the St. Lucia rainfall returns for 1916. The heaviest total rainfall occurred at Woodlands where it amounted to 144.13 inches. The lowest rainfall was at the Agricultural and Botanic Station, Choiseul, where 59.81 inches were recorded. At the Botanic Gardens in Castries the total rainfall for the year was 110.48 inches. A useful feature of the table under notice, and one only recently introduced, is the column giving the number of days on which rain fell, which enables one to calculate the effective rainfall. This observation is now being made in most of the West Indian islands.



POULTRY NOTES.

ROUP.

Information regarding the nature and treatment of roup, which is admittedly the most dreaded, because it is the most widespread, disease of poultry, and the one more difficult to handle than all others put together, is contained in an article in *The Agricultural Gazette of New South Wales*, for March 1917.

Much has been written in connexion with roup, and various remedies have been suggested from time to time for eradicating the disease. There is a widespread notion amongst poultry keepers that, so long as everything is kept clean, fresh clean water regularly supplied, the poultry house disinfected, and the chickens dosed with chemicals from time to time, immunity from disease is sufficiently ensured. But this is a fallacy that is calculated to keep poultry keepers from a proper appreciation of the real cause. Cleanliness and sanitation, while commendable and, of course, quite necessary to the health of the birds, are not sufficient in themselves to keep away roup. Good, airy, well-ventilated poultry houses, and strong well-developed stock are the best safeguards against this.

The remedies suggested in the journal above-quoted appear to be simple, practical and inexpensive. It is stated that scientific research into the nature and cause of this disease amongst poultry has established the fact that it is not caused by any one specific microbe, but by a class of microbes; hence the difficulties in the way of preparing a serum with which to combat it as is done in the case of diphtheria in human beings, although the two diseases are in many respects analogous, and, indeed, the disease of poultry is often called diphtheric roup.

There are three recognized kinds of the disease known as roup. The first, and most difficult to cure is that affecting the head with a putrid discharge from the nostrils, coming like a catarrh, and often spreading to the eye, which becomes swollen and filled with pus. The best method of treating this form of roup is to syringe out the nostrils, and, if necessary, the eyes, at least twice a day with equal parts of peroxide of hydrogen and water; but the following may also be used with some measure of success: kerosene (undiluted), or a strong solution of permanganate of potash, or boracic acid and salt solution, using a teaspoonful of boracic acid and half a teaspoonful of common salt dissolved in half-pint of boiling water. If no other suitable syringe is handy, a common sewing machine oil-can may be used for the purpose. A good way to get the bird to clear its head and nostrils of the mucous is to submerge the head up to the eyes in a solution of permanganate of potash made about the colour of claret. The immersion should take place for a few seconds, the bird's head being held in such a position that it cannot breathe without taking in the solution; this will cause it to eject much of the objectionable matter. If this is done previous to the syringing, the latter will be much more effective.

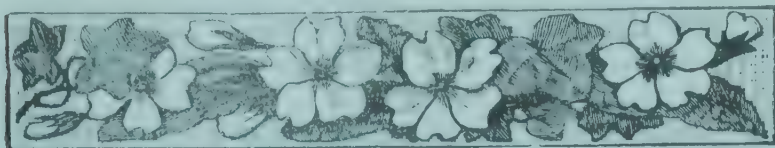
The second kind is what is known as diphtheric roup. This may be recognized by a thick, false membrane, somewhat of the character of mucous filling the throat and mouth. This is most deadly if left to itself, as it will quickly choke the bird; but it is, perhaps, the most easily treated. Flowers of sulphur lightly dusted into the mouth and throat twice daily for two or three days, will usually clear it.

The third variety is known among poultrymen as canker; this form is less prevalent, and, perhaps, less contagious than are the others; but it attacks young and old alike. It has, however, a less debilitating effect upon the birds. In fact, they may have this disease and still appear in the best of health. The symptoms of canker are a gasping or choking sensation, and the bird will sometimes cry out in its endeavour to get its breath. Upon examination they will be found to have a cheesy-looking substance growing round the windpipe, and sometimes in the mouth on the side of the throat or even on the tongue. In cases where it is round the windpipe it may grow to such an extent as to block up the air passage, causing asphyxiation.

The remedy is to remove this substance with a piece of wire bent in the form of a small loop, taking care that the affected part is not made to bleed; also, when round the windpipe, that no particle is allowed to fall in that aperture, or the result will be fatal. After the removal of the substance the affected part may be painted with a saturated solution of permanganate of potash, or glycerine and iodine in the proportion of 1 part iodine to 10 of glycerine. Another, but rather drastic, remedy is to apply very finely powdered bluestone and permanganate of potash in equal quantities well mixed. In each case the remedy should be applied twice daily.

Spraying Yellow Pine-apple Plants with Iron Sulphate Solutions.—The yellowing of pine-apples on the black manganese soils of the island of Ohau in Hawaii has been a serious problem to growers for a number of years. From a study of the ash analyses of different kinds of plants, it has been found that the plants to which the manganese soil appeared toxic, such as pine-apple, corn, pigeon pea, have less iron in their ash when grown on manganiferous soils than when grown on normal soils. Ash of such plants as guavas and weeds growing wild on the manganese soils without apparent ill effects showed no decrease in iron, yielding even more iron than when grown on normal soils. The other elements in the ash showed no such significant variation. It thus appears that the unhealthy growth on the manganese soil is due to lack of iron in the plants, and that the plants are suffering from iron starvation in spite of the abnormally large quantities of iron present in the manganese soils.

According to Press Bulletin No. 51, issued by the Hawaii Agricultural Experiment Station, Honolulu, which deals with these matters, the application of solutions of iron salts to the leaves has been found to be the only promising treatment. The application of iron to the soil has no effect. Extensive experiments conducted have demonstrated the practical value of the iron spray treatment, especially if the spraying is carried out directly the first indications of yellowing make their appearance. It is hardly necessary to enter here into the details of the work since this affection of the pine-apple does not occur in the West Indies. Details may be obtained by reference to the Bulletin quoted in the course of the foregoing note.



PLANT DISEASES.

CEPHALOSPORIUM DISEASE OF SUGAR-CANE.

The Report of the Barbados Department of Agriculture, for 1915-16, issued as a supplement to the *Official Gazette* of April 16, 1917, contains an account by Mr. J. Sydney Dash, Assistant Superintendent, of the epidemic of a sugar-cane stem disease which occurred in that island in 1915. Some notes on the subject appeared in the issue of this Journal dated January 1, 1916. The outbreak had a distinctly curious history. In the absence of any obvious irregularity in the weather conditions, and although there is good reason to believe that it is not a recent introduction, the disease assumed epidemic form with apparent suddenness and with a wide distribution.

Appearances suggested the beginning of a severe attack, but its progress was arrested as quickly as it had begun, and the actual damage done was not serious. So far as is known to the reviewer there has been no notable recurrence this year.

The principal addition to our information afforded by Mr. Dash's account lies in his description of inoculation experiments carried out with cultures of the *Cephalosporium* isolated from the diseased canes.

Some fifteen sound, healthy canes were selected for the purpose and the wounds were made with a sterile cork borer; the cylinder of cane was replaced in the hole after a drop of the spore material had been put in with a loop needle, and finally a piece of sterile cotton was bandaged over the wound for protection. The inoculations were made on December 28, 1915. On February 8, 1916, the first examination was made; two inoculated canes were examined and a similar number of controls. Near the wound the tissues were generally invaded by the fungus, which was re-isolated. Further away from the wound the fungus followed the track of the fibrovascular bundles. The infection extended one internode each way from the point of inoculation. In the controls, only the injured cells around the wound were discoloured but no fungus was found. On March 30 another examination was made; four of the inoculated canes were removed. Infection had taken place but little progress was made beyond the results of the first examination. On May 18 the remaining canes were removed. After a period of four and a half months, only in two instances was the fungus found to have penetrated almost the entire cane, and these two canes had evidently sustained injuries of some sort; one was damaged by borer at the root and the other showed signs of an incipient attack of *Colletotrichum* near the base. In all the others the fungus had made very slow progress, two internodes on each side of the one which had been inoculated, were the most that had become infected. One control was attacked by weevil borer near the wound and was useless for comparison. The remainder only showed discoloured tissues near the wound but no fungus was present, neither did they show any discoloration of the bundles as noted in the inoculated canes.

The conclusion reached is that the disease is not of a virulent nature, progress being slow, and so far as could be seen, confined to canes whose normal growth has been interfered with, apparently, in the outbreak under consideration, by the wrenching action of strong winds or the presence in the stool of the root fungus *Marasmius sacchari*.

SUGAR-CANE DISEASES IN PORTO RICO.

The Fifth Report of the Board of Commissioners of Agriculture of Porto Rico, for the year ending June 1916, contains a report by the Pathologist, Mr. John A. Stevenson, on diseases of sugar-cane.

The report opens with the statement that there has been heavy loss from cane diseases in the season referred to. This has not been due to the introduction of any new and strange diseases, or to any sudden assumption of virulence on the part of those fungi already occurring on the island, but rather has been the result of an accumulation of disease due to a favourable combination of climatic and cultural conditions. The trouble has occurred in a comparatively dry region of the island, and for the most part in the fields of small holders.

The conditions described are such that no one acquainted with cane growing would be surprised at the result. The high price of sugar has led to a great extension of the acreage planted, for which neither cultivation nor fertilizer was adequately available; and this on heavy long-tilled soils. Excessive rainfall in November and December was followed by severe drought in February, March and April.

The general effect was to be seen in a stunted appearance of the fields, poor colour of leaves, and the presence of blank spots where stools had died out completely. The stalks were small, with close joints, and the internodes discoloured or more or less completely covered with deadened irregular areas, sometimes not extending deeply into the tissues, but at other times forming deep cankers. The few living leaves were narrow and peculiarly mottled. The lower leaf-sheaths were commonly cemented together by the white mycelial growth of one or more of the fungi connected with root disease. The underground portion of the stools was in advanced cases dry-rotted and permeated by the white mycelium of the 'stellate crystal fungus.'

The picture thus presented is not, in its general aspect, an unfamiliar one in these islands. For want of a wider term the type of trouble depicted is commonly called root disease, sometimes, perhaps, froghopper blight. With the definite clear-cut effects which may be produced by *Marasmius* or *Tomaspis* it has little intrinsic connexion, and it calls for the ministrations of the agricultural instructor rather than those of the pathologist.

W.N.

The influence of certain carbohydrates, chiefly sugars, on green plants is described in a note in the *Experiment Station Record*, Vol. XXXVI, No. 2. Corn (maize) was found able to absorb through its roots and to assimilate certain sugars, which resulted in increased growth of the plant. The sugars in the order of their beneficial effect on the plants when grown in the light were glucose and fructose, saccharose and maltose. In the dark, glucose gave the most beneficial results. With Canada field peas (*Pisum sativum*) growth was found to respond markedly to the presence of sugars, the order of their beneficial influence being saccharose, glucose, maltose and lactose.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market, for the month of March 1917:—

Though there was a distinct decline in the amount of business transacted in the produce market at the beginning of the month (March), prices generally were firm, and in many instances were advanced from those prevailing in February. These remarks refer specially to ginger, nutmegs, pimento and citric acid. Later on in the month there was a slight improvement in the number of purchases which, however, continues very restricted, the quantities purchased being only sufficient for current needs. The following are some of the principal details.

GINGER.

At the first spice auction, Jamaica was quoted at 85s. to 105s. per cwt., washed Cochin at from 60s. to 65s. and African at 45s. A week later the quotations had risen to 90s. to 95s. for common to good common Jamaica, and 100s. to 110s. for medium to good, while 65s. to 67s. 6d. was asked for washed Cochin. At the sale on the 14th of the month some 337 bags of rough washed Cochin were brought forward and 173 sold at increased rates, partly wormy fetching 61s. per cwt. Some 80 bags of limed Japanese, slightly wormy, were also offered and bought in at 50s. per cwt. Quite at the end of the month it was reported that these prices were being maintained or even exceeded at ports of arrival.

NUTMEGS AND MACE.

Nutmegs were in good supply at the spice auction on the 21st when 224 packages of West Indian were offered and sold at steady rates: 45 packages of West Indian mace were also offered and sold at an advance on previous rates of from 1d. to 2d. per lb., good bold fetching 2s. to 2s. 2d. per lb., fair 1s. 9d. to 1s. 11d., ordinary 1s. 7d. to 1s. 8d., and broken 1s. to 1s. 2d.

SARSAPARILLA.

There has been very little business in this drug during the month. At the first auction on the 8th of the month sarsaparilla was represented by 13 bales of native Jamaica, 7 of Lima, and 50 of Mexican; only 7 bales of the first were sold, and none of the other two. Of the first named 1s. 4d. per lb. was paid for 5 bales of red and yellow mixed, and 1s. 3d. for 3 bales of yellow. At the end of the month it was reported that there was a great scarcity of this drug from all sources, and consequently much wanted.

CITRIC ACID, PIMENTO, ANNATTO, CASSIA FISTULA, KOLA, LIME JUICE, LIME OIL, AND CASHEW NUTS.

At the beginning of the month citric acid was quoted up to 3s. 4d. per lb., a price that prevailed up to nearly the end, when it advanced 3s. 5d. Pimento advanced at the beginning of the month from 4½d. to 5d. per lb., but declined again towards the close to 4½d. At auction on the 8th of the month some 20 bags of annatto seed from Jamaica were offered, but failed to find buyers, 9d. to 10d. per lb. being asked. At the same auction 58 baskets of fair Java Cassia Fistula pods were offered, but also failed to find buyers; 50s. per cwt. was asked. Kola was well represented at the first auction by 221 packages, all of which were disposed of at 6d. per lb.

for fair Java halves, 5½d. being paid for fair West Indian halves and whole. Later on in the month some smaller quantities were received from West Africa, which were disposed of at from 4d. to 4½d. per lb. At the first auction on the 8th of the month a puncheon of brown West Indian lime juice was sold without reserve at 9d. per lb. Towards the end of the month it was stated that good West Indian was plentiful, with a quiet demand at 2s. 9d. per gallon. Lime oil at the first auction was represented by 12 cases, all of which were disposed of; West Indian distilled fetched 8s., at which price it remained at the end of the month. Cashew nuts were in good supply at the first auction in the month when 196 packages were offered but none were sold. Later on it was reported that there was a good demand at 75s. per cwt.

GALL PATCHES OF ANTIGUA SOILS.

In a paper published in the recently issued number of the *West Indian Bulletin* (Vol. XVI, No. 2), Dr. H. A. Tempamy explains the origin of these curious areas in the limestone district of Antigua which are incapable of producing satisfactory crops of sugar-cane.

The question has already been considered in a paper by Dr. Tempamy on the soils of Antigua, in which it has been shown that the effect in question is due to physical abnormalities or to the presence of excessive amounts of calcium carbonate in the soil. Chemical analyses of such soils show that they contain large amounts of alkali soluble in hydrochloric acid. The suggestion put forward is that the result is probably due to the presence of sodium carbonate in the soil.

Further investigations have fully confirmed this view. These investigations have comprised examinations of the water extract from gall patch soils; the cultivation of canes in tubs containing gall patch soils, which in the one case was untreated, and in the other had been thoroughly washed out with rain-water; the examination of the leaves of etiolated cane plants growing on gall patches in comparison with leaves from healthy canes; and the investigation of certain biological activities of gall patch soils.

The results indicate clearly, that the effect in question is due to the presence of sodium carbonate in the soil. The origin of this sodium carbonate is attributed to interaction between the calcium carbonate and the sodium chloride dissolved in soil water, and brought up from saliniferous deposits at deeper levels.

The illustration (A) in the *West Indian Bulletin* shows the growth of sugar-cane in a sample of 'gall patch' soil washed out with successive floodings of rain-water for a week; and (B) cane growing in untreated gall patch soil.

Diminishing Freight Facilities in the West Indies.—The strong probability that there will shortly be a serious reduction in the number of steamers running regularly between the West Indies and North America makes it desirable to bear in mind the importance of producing as much food as possible locally in these islands. The matter has been brought before the public for some months now in most of the colonies, both officially and by the Press; articles have frequently appeared in this Journal, and those planters who have hitherto ignored the matter would be well advised to give it their earnest consideration while there is yet time to act with deliberation and effect.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
April 5, 1917.

ARROWROOT—4½d. to 6½d.
BALATA—Block, no quotations; Sheet, no quotations.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, 65/- to 82/-;
Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£43.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £21 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, 90/- to 100/-.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—4½d.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., April 11, 1917.

CACAO—Caracas, 12½c. to 12¾c.; Grenada, 12c. to 12¼c.; Trinidad, 11¾c. to 12c.; Jamaica, 10½c. to 11¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$42.00 to \$44.00; culls, \$28.00 to \$30.00.
COFFEE—Jamaica, 9½c. to 11½c. per lb.
GINGER—16½c. to 20c. per lb.
GOAT SKINS—Jamaica, \$1.20; Antigua and Barbados, \$1.10 to \$1.15; St. Thomas and St. Kitts, \$1.00 to \$1.10 per lb.
GRAPE FRUIT—Jamaica, \$1.25 to \$1.75.
LIMES—\$5.00 to \$6.50.
MACE—37c. to 42c. per lb.
NUTMEGS—21c. to 22c.
ORANGES—87½c. to \$1.50.
PIMENTO—5¾c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 6.27c; Muscovados, 89°, 5.75c.; Molasses, 89°, 5.25c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., February 23, 1917.

CACAO—Venezuelan, \$14.00 to \$14.25; Trinidad, \$17.28 to \$17.76.
COCO-NUT OIL—\$1.45 per Imperial gallon.
COFFEE—Venezuelan, 12½c. to 14½c.
COPRA—\$7.25 per 100 lb.
DHAL—No quotations
ONIONS—\$7.00 to \$8.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$4.00 to \$5.00 per 100 lb.
RICE—Yellow, \$8.40 to \$8.75; White, \$9.25 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., April 17 1917.

ARROWROOT—\$6.00 per 100 lb.
CACAO—\$13.00 per 100 lb.
COCO-NUTS—\$24.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$6.75.
PEAS, SPLIT—\$10.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$10.50; Patna, no quotations; Rangoon no quotations.
SUGAR—Muscovado centrifugals, \$4.75.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	MESSRS. WIETING & RICHTER.	MESSRS. SAND- BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



A FORTNIGHTLY REVIEW
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The Principles of Education.

THE time has arrived for the general public throughout the British Empire to recognize and understand the full meaning of education. Many people consider that they do, yet ninety-nine out of a hundred are quite incapable of explaining even the principal aims of education.

In considering the subject in its broadest aspects it is convenient to differentiate more or less sharply between the education of the child and the education of the man; that is, between primary and secondary education, and university and technical education.

According to A. C. Benson* whose ideas are largely drawn upon in this article, the aims of primary and secondary education should be first of all to fortify the health and character; secondly, to detect aptitude and ability; and thirdly, to disseminate a general knowledge of the world in which we live.

The present war has clearly shown that the human intellect cannot be depended on to secure peace and happiness. Knowledge is power, but only in the potential sense. Its application is what affects the national life, and this is governed to a very large extent by the desires of human nature—by human motives. Hence the first aim of education should be to inculcate in the mind of the child an appreciation of high principles, a sense of justice, and a sympathetic regard for other people's interests and feelings. An attempt must also be made to strengthen the character so that these principles may be adhered to and, if necessary, enforced upon others. Finally, there must be due appreciation of the importance of bodily as well as mental health, and education should be directed, by means of its disciplinary influence, to bring this about.

The detection of aptitude and ability is considered by some to be the most important aim of education, for whilst education can do much to form the character and train the mind, the fundamental characteristics must first of all be known to be there.

It will be enlightening at this point to consider the material with which in most countries elementary and secondary education has to deal. According to Benson, it may be divided into three rough classes: At the top come the people, not very numerous, of

*A. C. Benson, C.V.O., on Literature and Science in Education, *Journal of the Royal Society of Arts*, December 22, 1916.

strongly marked individual capacity and ability, who are exceedingly good at a variety of subjects. At the bottom are the people who are clearly slow and dull, and find great difficulty in applying themselves intelligently to any subject. Then there is a much larger second class of fair straightforward capacity, not markedly good at any one subject and not markedly feeble; and it is these who are the chief problem. The first class need careful special training and higher education, the third class are probably not adapted for any intellectual education at all. The second class are the real difficulty.

Here it will be instructive to observe that in the West Indies—at least as far as primary education is concerned—there is a difference. The third class containing those who cannot profit by intellectual education is much greater than the second class of medium mentalities. There is consequently a much greater waste of educational effort in the West Indies than in other countries like Great Britain, and this fact ought to be recognized and attended to.

But it is a great mistake to imagine that a dull person is necessarily useless. He is only useless in an intellectual sense. Properly trained in some handicraft he may become a highly useful citizen. And this brings us to consider the difference between education and mere instruction. The one does not necessarily imply the existence of the other, for people can become educated without receiving definite instruction, and people can be definitely instructed without becoming properly educated. The dull people must be instructed in the way to do things without being expected or required to think.

It is generally recognized that one of the chief educational difficulties is the dearth of good teachers. This is because the public do not believe in education sufficiently, or rather do not understand what it means, to pay teachers properly, to make it a career for the best men. What is needed in the teacher is originality and power to inspire, as well as clear intellect and knowledge. Such men cannot be obtained unless the prizes which the profession can offer are as good as in other professions. Teachers are notoriously underpaid in the West Indies, both in secondary and primary education. Reform is needed in this direction, and if the public revenue will not allow of greater expenditure on education, then the number of schools or the size of the schools should be reduced by excluding from an intellectual education those people who do not possess the natural aptitude to benefit by it.

As to the relative position of literature and science in education there are very strong views prevalent at present, and most of them are extreme views. It is important to realize that education is not the study of literature or of science but the desired result of such studies. A literary education, which includes the classics, is a study of all that deals with the emotions, hopes, fears and desires of mankind, with the best and loftiest visions of the human soul, with great human achievements and self-sacrifice. A scientific education concerns man's material surroundings the study of which, in a general way, is equally essential for producing a well-informed and enlightened citizen. But in teaching science in primary and secondary schools we must not be too disposed to think that scientific facts in themselves are of first importance. Scientific ideas and the cultivation of an orderly habit of mind are the things to be aimed at first. The accumulation of knowledge and the search after knowledge are more properly confined to higher education and the training of specialists.

It is frequently held that the study of science tends to develop a materialistic mind. To rectify this we consider more should be done to blend science and the study of art. For instance, it is possible to regard a flower both as an object of scientific interest and as an object of beauty—beauty both in the sense of being wonderful and in the sense of beauty of form and colour. The recognition of beauty is stimulating to the imagination, and the development of the imagination inspires a sympathetic and kindly attitude of mind.

The systematic study of science is far more important in higher education than it is in primary or secondary education. What is most needed at present is not so much more science in the schools as better methods of detecting real aptitude for science, and better facilities in the universities so that the best abilities and capacities may be set free to pursue their own bent. It is also necessary that remunerative appointments should be created for people thus educated. This latter point is one to which much attention is now being given, principally as a result of the war.

Our chief consideration in this article, however, is general education; and it must be admitted that conditions in the West Indies fall very far short of the ideal. General education in these colonies fails in many directions, but the most noticeable one is in connexion with discipline and public opinion. Many

West Indians are far too self-opinionated and self-sufficient; a great many are irresponsible. It is therefore important that the first aim of education, the training of the character, should be kept in view and more attention given to enlightenment in connexion with ideas and ideals rather than mere instruction in book knowledge.

MOTOR PLOUGHING.

GOVERNMENT ASSISTANCE TO TENANTS IN ENGLAND.

The British Ministry of Munitions which owns a very extensive tract of fertile agricultural land, in connexion with a munitions factory in the north of England, is encouraging its tenants to cultivate hundreds of additional acres by assisting in the ploughing of the land with tractors.

Four American Mogul tractors, of 16 horse power each, with Canadian 'Cockshut' three-furrow ploughs attached, have been at work in this vicinity for two months, and, under the organization and superintendence of Captain Shand, the resident land agent, who represents Sir Howard Frank, the Director General of the Ministry of Munitions lands, splendid work has been done.

The introduction of the tractors has aroused much interest amongst the agricultural community and although at first farmers were somewhat sceptical, they have become quite enamoured of the new invention. So complete indeed has been their conversion that they are in frequent communication with the agent in charge of the work with a view to buying the tractors after he is done with them.

On the Ministry lands the tractors are manned by Army Service Corps M. T. Drivers. Each tractor has a speed of about 3 miles per hour, and the engines, which start on petrol, are worked by paraffin, the consumption of oil being about 2½ gallons per acre. Highly satisfactory work has been done on both lea and stubble land. The ploughs turn the land over to a depth of about 7 inches, and the furrows are even, clean, and straight. The average amount ploughed in a full day under very adverse conditions has been 5 acres per tractor, but it has been ascertained that under ideal conditions each tractor can easily plough three quarters of an acre in an hour. Although a certain amount of ploughing has been done after dusk, with the aid of acetylene lamps, much better results are attained by working in daylight, and, with the introduction of Summer time, two shifts are now resorted to—the one from 4.30 a.m. till noon and the other from noon till 8 p.m.

Besides being useful for ploughing the tractors will be of great assistance during harvest in hauling the binders, in thrashing, and in taking the grain to the market.

COCO-NUT SELECTION IN SEYCHELLES.

The increase in the coco-nut crop for the year 1914 was not continued in the year 1915, and the reduction in the crop was so large that it gave rise in the Colony to much apprehension. According to the Annual Report on Agriculture and Crown lands in the Seychelles for the year 1915 the crop for that year was about the same as that for 1913, while the crop for 1914 was larger by about 5,000,000 nuts. The writer of the report does not think that this large reduction can be explained on the basis of external

But there is an internal factor which has probably had an influence during the year under review, and that is the fact that in all fruit trees one often sees a period of under-bearing following a period of over-bearing. The crop for 1914 was a very large one, and the coco-nut trees being unmanured, the balance in the physiological conditions of the trees may have been upset. The writer states further that coco-nuts seem to contract the habit of flowering and fruiting more abundantly at certain periods of their growth, and certain varieties are known to produce large crops at longer intervals, such as a variety of the King's coco-nut in Ceylon, which produces only one crop in two years, in spite of all artificial measures adopted to make it fruit more frequently. The tree No. 1 in the Seychelles list of varieties is a King coco-nut from Java, and the periodical flowering of it is also interrupted by long periods of rest.

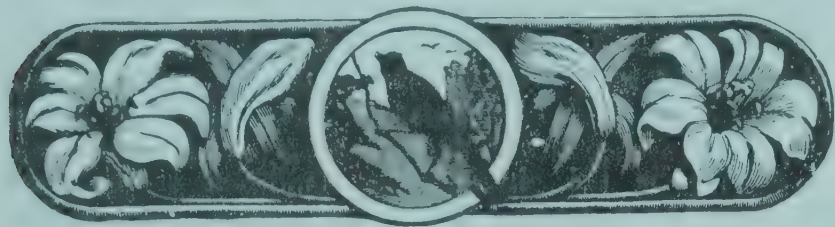
In regard to varieties, variations in the yield of copra per 1,000 nuts are being recorded from widely different localities in order to be able to classify the trees growing in all parts of Seychelles. In regard to selection, it is proposed on Government land to interplant at once trees selected for their large nuts although short in the number of female flowers, such as Ceylon varieties, together with local strains of known type such as the 'coco raisin' which produce such a great number of female flowers that sometimes as many as fifty nuts are counted in one bunch. The result of this experiment will be awaited with interest.

CULTIVATION OF THE PALMYRA PALM.

In the first part of the Annual Report on Agriculture and Crown Lands in the Colony of Seychelles for the year 1915, it is stated that a comparatively large area has been devoted to palmyra palm (*Borassus flabelliformis*). This palm has thrived well. Seedlings set out in inferior soils where coco-nuts are handicapped have reached 7 feet 8 inches in three years. Although the palm does not grow quickly, it produces many different articles for local consumption and export. It is said that in South India and Ceylon no less than 801 uses have been found for the products of this palm, but in the report under review the writer has refrained from giving more than seven. It is stated that first of all the young root is cooked and eaten as a vegetable; the inside of the nut is also eaten; the leaf-stalks form palings for fences, while the leaf is used for thatching. Four kinds of fibre are obtained from the leaf-stalk; while the flower-stalk, both from male and female trees, produces a sap from which sugar (jaggery) or vinegar is manufactured. The fruit is much used as fodder for animals; the unripe fruit contains a jelly which is said to be most refreshing and wholesome. Palmyra wood is used as rafters, and has been described as 'the first wood in India'. These rafters are exported in considerable numbers from Jaffna.

It is possible that the cultivation of this palm might be suitable for certain districts in West Indian islands like Antigua. The point seems to be that the palm can be successfully grown in places which are not as well suited for coco-nuts.

Shipments of sponge and a small conch shell shipment were made to the United States from Turks Islands during last January. Canned lobsters were also being shipped. These find a ready sale in the United States at a good figure. (West India Committee Circular, April 5, 1917.)



DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Mr. J. C. Moore, Superintendent of Agriculture, reporting for the month of April, states that work in the Experiment Stations was of a routine nature, while in the Botanic Gardens the principal operations consisted in watering nurseries, mulching lime beds and preparing land for yams. The condition of the staple crops was reported as normal. The Agricultural and Commercial Society was vigorously pushing a campaign urging all agriculturists having available land to extend the cultivation of ground provisions and corn as rapidly as possible. Committees of planters have been formed in several parishes, and the Governor has approved of the Agricultural Instructor, W. M. Malins-Smith, devoting practically the whole of the next three or four months to active work in this campaign, in co-operation with the local Committees, and under the control of the Agricultural and Commercial Society. The temporary loss of Mr. Smith's services to the Department at this time is much to be regretted, but the urgency of the work he is taking up and his qualifications for it are considered sufficient justification. The officers of the Department will endeavour, as much as possible, to prevent the work in hand suffering any serious set-back.

Excellent tillage work has been done during the past six months on the Grand Anse estate. A considerable area has been ploughed and ridged for cane, and plants put in during December and February are making very good progress. It is probable that a motor plough will be tried on this estate in the near future.

Preparation for distributing seed corn, yams, and eddoe plants from the Department has been made. Stored seed corn still continues in good condition. Work contemplated includes construction of a culture cabinet and steam generator for the cultivation of thrips fungus; continuation of the thrips investigation work; inspection of two estates for land settlement purposes; and Prize-holdings Competition work in Grenada and Carriacou. The weather during the month was very dry, with occasional high winds: rainfall at Richmond Hill 0.17 inches.

ST. VINCENT. Mr. W. N. Sands, the Agricultural Superintendent, in his report for the month of April states that work in the Experiment Stations and Botanic Gardens was of a general routine nature. Plant distribution included eighty-one coco-nuts. The weather was dry, and beyond the cleaning of lands for planting and the harvesting of cane, arrowroot and cassava, there was little to report. The corn mill at the ginnery was worked continuously and the daily demand for corn meal exceeded the supply. The destruction of silk-cotton and 'John Bull' trees was continued in the Leeward and Windward districts by the Agricultural Department. The Agricultural Superintendent paid a visit to the Grenadines and addressed large meetings of the inhabitants of Union and Bequia islands on local food problems and how to grapple with them. He also advised on the planting and marketing of crops for the coming season. The owners of Mayreau island were interviewed and similar questions were discussed with them. Estates and small holdings were visited at Union

and Bequia. Mr. S. C. Harland, the Assistant Superintendent, was granted three months' vacation leave as from the 30th, and left for Canada on that date. Departmental arrangements for the carrying on of his duties were approved of.

ST. LUCIA. Owing to the severe drought no planting operations could be carried out in the Experiment Stations during the month of April. Work consisted in repairing roads, weeding, manuring and pruning; grafting mangoes and budding oranges and grape-fruit, and spraying cattle. Plant distribution included 900 lime plants, 70 ornamental and decorative, 245 packets vegetable seeds. In the Botanic Gardens, pruning hedges, cleaning drains, poisoning crabs, levelling lawns, repairing fences and potting nursery stock represented the work done. In regard to staple crops, Mr. Brooks states that the reaping of cacao was continued, lime trees were flowering and the reaping of the sugar crop was practically over. A new area was being cleared for planting lime trees. Public meetings were held in Choiseul and Laborie in connexion with the proposed Government sugar factory at Réunion. The proposal, which has the fullest support of all the leading planters in the district concerned, is warmly welcomed by the peasants everywhere.

The Agricultural Superintendent was appointed a member of a committee formed by His Honour the Administrator to enquire and report under what conditions natives of St. Lucia at Panama should be repatriated, and what provision can be made for their useful employment in the Colony. The first meeting of this Committee was held on April 23, when a circular was drawn up for distribution to planters throughout the island seeking information as to what assistance they would be willing to render the scheme, in the way of providing house accommodation and employment. An Assistant Agricultural Instructor has been appointed for the duration of the war. This officer will reside on the Windward Coast and work the districts of Micoud and Dennery. The rainfall for the month was: at the Botanic Gardens, Castries, 1.93 inches; at the Agricultural and Botanic Station, Choiseul, .76 inch.

DOMINICA. Mr. Joseph Jones, the Curator, writes to say that during the month of April work in the lime experiment station comprised picking and recording the crop, weeding and cutlassing; in the cacao experiment station heavy pickings of cacao were made and recorded; while in the coco-nut experiment station close on 5 acres of land was cleared, for the extension of this station. Owing to dry weather conditions plant distribution practically ceased. A further consignment of cane plants—this time the gift of the Government of Martinique—was received and distributed on the windward side of the island. In the Botanic Gardens general routine work was carried on in keeping the gardens in order. In his observations relating to staple crops, Mr. Jones states that an excellent carême crop of cacao ripened rapidly during the month and good weather conditions were experienced for drying the same. There was considerable activity in the green lime trade and the prices ruling for the previous month were maintained. Work in the chemical laboratory included the examination of a case sent in by the Customs authorities; the analysis of a sample of citrate of lime; the testing of several samples of raw and concentrated juice; analyses of two samples of milk sent in by the Roseau Town Board, and the examination of two samples of washings from sludge. At the invitation of the local Chamber of Commerce, the Curator discussed with the special committee appointed for the purpose, various means of improving the status of the green lime trade. The weather was very dry, the rainfall for the month being only .17 inch.

MONTSERRAT. In detailing operations in the Experiment Stations during the month of April, the Curator, Mr. W. R. Robson, states that the cotton-breeding plot of twenty-five types was planted, as well as the cotton manurial plots. Considerable trouble has been experienced on the former plot through the attacks of the common slug. On account of the continued dry weather, other work was routine in character, and included the reaping of pigeon peas, Lima and Madagascar beans, and Ajowan seeds. Bay plants distributed numbered 1,250. In the Botanic Gardens the pine-apple experiment plot had become hopelessly diseased by 'wilt', and was dug out. Further spraying was necessary on the lime experiment plot. Two distillations of Bay leaves were made but the work is at present suspended on account of the breaking down of the still. In regard to staple crops, it is stated that some districts had good showers and a considerable portion of the cotton crop had been planted. General weather conditions however, have not been favourable for obtaining a good stand of plants, and rains are urgently needed. Stocks of seeds for planting purposes have run low and it has been necessary to import from neighbouring islands. The area planted by peasants will exceed that of any previous year. Latest sales of last crop were at 38d. The crop has much exceeded the estimate and will be over 300,000 lb. of lint. A very medium crop exists on the lime trees on account of the dry weather in March and April. The recent improvement in the market of muscovado sugar is stimulating to those interested in its manufacture. In continuation of previous work a survey was made of the lime fields in the Grove neighbourhood for disease, but no particular changes were observed. The rainfall at Grove Station for the month was 2.58 inches, total for the year 13.58 inches. The average rainfall at twenty-two stations in 1916 was 67.69 inches compared with an average of 57.08 inches for the previous twenty-two years. Mr. Robson mentions that it is in contemplation to carry out experiments on the lime experiment plot in Belle field to decide the best manner of using Bengal beans as a cover for lime trees.

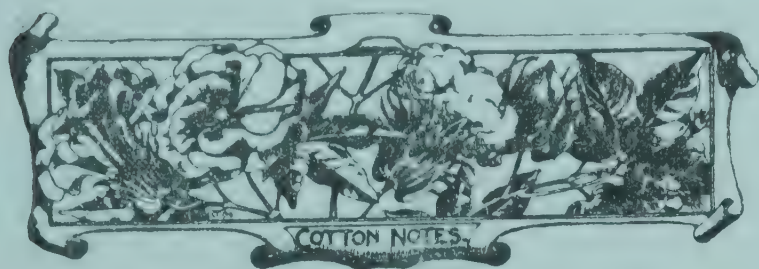
ANTIGUA. During the month of April work in the Experiment Stations consisted in the reaping of crops on the various experiment plots. Plant distribution included sisal 815, henequen 470, miscellaneous decorative 20, seeds (cotton) 140, (vegetable) 4 packets. The work in the Botanic Gardens was more or less of an ordinary routine nature. Regarding staple crops, Mr. Jackson states that during the early part of the month the young canes suffered severely from drought—in fact a number of young plants died from this cause. Cultivation of land was commenced on some estates, and during the latter end of the month some few acres of cotton were planted. The planting of sisal was continued in the windward district of the island. There is every reason to believe that the area under cotton in Antigua will be increased during the coming season. During the month 979 lb. of cotton was purchased for the Antigua Cotton Growers' Association, making a total to date of 7,247 lb. in round numbers. The number of crates of onions shipped during the month for the same Association was 1,036, making a total for the season of 5,560. This is a record. Work in selecting cotton seed of pedigree strain for planting purposes was commenced. The weather for the first three weeks of the month was exceedingly dry; during the last week good general rains fell. The rainfall for the month was 2.22 inches, for the year 7.95 inches.

NEVIS. Mr. W. I. Howell, the Agricultural Instructor, states that during the month of April the plots in the Experiment Stations were all kept in good order, but on account of the very dry weather no planting was done, and

the crops are suffering much from want of rain. Preparation of the cotton demonstration plot was completed and planting would commence as soon as enough rain fell. On account of the dry weather the distribution of plants was very small and comprised only 163 lb. of cotton seed, 2 lb. of Lima beans, and 2 lb. of black-eye peas. Concerning staple crops, the reaping of the cane crop was still in progress, but the returns were poor, while many of the fields were getting very dry. The young canes throughout the island were suffering very much from want of rain, and in many fields a fairly high percentage of the plants had died. A great part of the cotton preparation was made up but on account of the very dry weather in some places operations had to be discontinued. About 200 acres of cotton will be planted at Salt Pond—preparation was almost completed and some planting had been done. The question of insecticides was creating some anxiety. The supply stocked by the local Government for the benefit of small growers had been exhausted and many of the larger growers were entirely without. On account of the weather also, very little planting of provision crops had been done, only in the high lands. The peasants are strongly advised to plant provision crops as soon as the rains come. There was an acre plot of the best variety of sweet potato at the Experiment Station, which would all be used for supplying cuttings to planters free; there was also a limited amount of Lima beans and black-eye seeds at the stations for free distribution. The work in the onion curing house was brought to a close on April 14. The rainfall for the month was 1 inch, for the year to date 8.24 inches.

VIRGIN ISLANDS. Owing to unfavourable weather, little could be done in cultural work in the Experiment Stations during the month of April. The preparation of land for cotton was pushed on and general cleaning up work continued. The Curator, Mr. W. C. Fishlock, states that, due to the same cause, there was no distribution of plants during the month. The general condition of crops in the islands was bad; the lime trees nearly all perished in the gale; the same remark applies to coco-nut palms. The cotton crop season as far as the Government factory is concerned was closed. There was no progress to report, everything being at a standstill. A visit was paid to Anegada and a meeting of the people addressed as to the need of planting all the food crops possible. A brief visit was also paid to Virgin Gorda (Sound and Valley). The weather during the last five months has been exceptionally dry. Rain fell in measurable quantity on nine days during April, the total measured at the Station being 0.91 inch; the average for the month for the previous sixteen years was 2.47 inches. The total rainfall registered from January 1 to April 30, 1917, was 5.97 inches as against an average of 10.87 inches for the same period for the previous sixteen years.

In a paper recently read before the Royal Society of Arts, Dr. J. A. Voelcker said that although certain crops like potatoes and fruit benefit largely from the application of potash, he did not regard the need of potash for general crop raising as being so urgent as was generally supposed to be the case. If farmyard manure can be supplied in sufficient quantity, it will in the case of most crops give all the potash that is required. Dr. Voelcker also referred to the somewhat curious action of basic slag, which in some cases produced beneficial effects and in others no effects at all. The action of this phosphatic manure would appear to need more investigation.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland, of Liverpool, write as follows, under date April 30, 1917, with reference to the sales of West Indian Sea Island cotton:—

There is a good demand for Sea Island growths, and spot quotations are easily obtainable, viz:—Nevis Montserrat, Antigua and Anguilla, 41d. to 42d.; Barbados, 42d. to 43d.; St. Vincent, 43d. to 44d.; Superfine, 55d. to 60d.; Marie Gallante 18d. to 20d.

The Report of Messrs. Henry W. Frost & Co., for Sea Island cotton in the Southern States, for the week ending May 5, 1917, is as follows:—

ISLANDS. This crop having been disposed of, the market will remain closed until the new crop comes in, which will not be marketed before next October.

GEORGIAS AND FLORIDAS. The market remains strong with the very limited offerings firmly held, at quotations.

There was little done on the spot, the sales reported consisting largely of cotton shipped from the interior markets to be forwarded to mills on contracts previously made.

We quote:—

GEORGIAS AND FLORIDAS.

Extra Choice & Fancy	70c = 72½c.	landed, including war risk.
Choice & Extra Choice	69c. = 71½c.	" " " "
Extra Fine & Choice	67c. = 69½c.	" " " "

The unsold portion of the crop is held largely by exporters either to cover forward sales, or on speculation. The stock in Factors' hands is reduced to 200 bales to 300 bales, and consists principally of the lower grades.

The exports from Savannah for the week were, to Northern Mills 818 bales, Southern Mills 8 bales, and from Jacksonville to Northern Mills 253 bales.

ACREAGE. There will be some increase in Carolina, about 10 per cent.; but in Georgia and Florida the increase is estimated at 20 to 25 per cent. The out-turn of the crop is dependent on weather conditions during the growing and harvesting season.

There is a very general apprehension that the boll weevil may do some damage, especially in Southern Georgia, where they appeared in a limited way last year.

With favourable weather conditions and no disaster from storms or boll weevil, it is estimated the crop may turn out to be 135,000 bales to 140,000 bales.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and fifty-ninth meeting of the Council of the British Cotton Growing Association was held at the Offices, 15, Cross Street, Manchester, on Tuesday the 1st instant. In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.), Mr. J. Arthur Hutton occupied the Chair.

Reference was made to the death of Sir William Houldsworth, Bart., a Vice-President, and one of the oldest friends and supporters of the Association, and it was decided that a letter of condolence be sent to Lady Houldsworth.

A special Conference of the Council with representatives of the Lancashire cotton trade was held on April 13 to discuss the cotton situation, when it was reported that no definite reply had been received from the Board of Trade with regard to the recommendations made by the deputation from the Lancashire cotton trade. This deputation took place on February 8, and a memorandum embodying the various points to be discussed was previously sent in to the Board of Trade. On February 13 an unofficial letter was received from the Board of Trade stating that a committee is in course of being appointed to investigate the question. As no further communication was received, a letter was addressed to the Board of Trade on March 22 pointing out the importance of the question receiving the immediate consideration of the Government, and an acknowledgment of this letter was received, dated March 23, since when no further letter has been received.

Considerable dissatisfaction was expressed at the conference at the delay on the part of the Government in giving a definite reply to the representations made by the deputation, and the following resolutions were unanimously passed:—

- (1) 'That this Meeting expresses its deep regret at the delay which has occurred in dealing with the question of cotton-growing in the British Empire, and its disappointment that no definite reply has yet been received from the Board of Trade on the various points submitted by the Deputation on February 8.'
- (2) 'That steps be taken to arrange for a conference with the members of Parliament representing the Textile districts to discuss the question.'

A question was asked in the House of Commons on the subject by Mr. C. T. Needham, M. P., who was informed that an announcement on this important subject would shortly be made. In view of this reply, it was not considered necessary at the present time to hold the meeting with the members of Parliament. It was resolved to approach the Employers' Associations with a view to a conference being convened as soon as possible when various matters connected with the cotton trade in addition to the question of the future of the cotton-growing movement could be discussed.

WEST AFRICA. The purchases of cotton in Lagos to April 21, amounted to 5,066 bales, as compared with 5,898 bales for the same period of last year, and 1,631 bales for 1915. In addition a cable has been received stating that there are 1,000 tons of seed-cotton on the railway awaiting transport, which is equal to a further 1,400 bales.

In Northern Nigeria the crop has suffered from the heavy rains in September, and the purchases to April 7,

amounted to 3,383 bales, as compared with 8,686 bales for the same period of last year, and 229 bales for 1915.

The Association have recently received a shipment of over 500 tons of seed from Lagos, but it has been necessary to destroy practically the whole of the remaining stocks of last year's seed, and it was pointed out that about 5,000 tons of seed had to be destroyed owing to the lack of freight. The seed is worth £13 to £14 per ton in Liverpool, and the opinion was expressed that it was a great pity that such a valuable food product should have to be wasted.

FINANCE. Attention was called to the large business now being conducted by the Association. The total value of the balance still unsold of the 1916 cotton crop from West Africa, Uganda, Nyasaland, and the West Indies, at present in Liverpool or on the water amounts to £212,000, and in addition to this the Association have purchased cotton of the 1917 crop in Uganda, West Africa and the Sudan, valued at £743,000, giving a total value of cotton in Liverpool, in transit or in Africa, of £955,000.

It was pointed out that the Association would have to pay War Risks Insurance at the rate of 5 guineas per cent. on about £750,000, and the increased rate of premium from 1 guinea to 5 guineas per cent. during the past few months means an increased cost to the Association of over £30,000.

AGRICULTURAL CREDIT IN TRINIDAD AND DEMERARA.

Recent issues of the *Port-of-Spain Gazette* have contained interesting reports concerning the present position in regard to agricultural credit in Trinidad and Demerara.

A Special General Meeting of the Diego Martin Agricultural Credit Society in Trinidad was held at the Government School house on Sunday, May 6, 1916. Among a very large gathering were Messrs. E. B. Jago, Chairman; J. R. Blandin and Theodore Bernard, Trustees; E. C. Clarke, F. A. Taylor, Fenton Jeremiah, Superville, Pollard, Salandy, Juman, Cuthbert, Mercer and others, with Mr. E. H. Matthew, Secretary. The reading of the minutes of the last meeting was postponed—the books being in the hands of the Auditors. The Chairman said his first duty was to welcome the new members. As they were aware, the society had applied to the Registrar for leave to increase their membership by twenty-five, which application was granted, but he regretted to say that the work of selection was very difficult. They had received seventy-seven applications—all from most deserving people hence it was tough work to reject fifty-two. He wanted, however, to assure the rejected that there was no reflection on their honour, and later on he hoped to be able to admit them.

GROUND PROVISIONS.

The Chairman said he had seen the Director of Agriculture about the lands being offered on the River estate for the growing of ground provisions. The Director was unable to offer the land at a lower rental, but was willing to accept half only in advance and the other half at the end of

the first year. If renters objected to planting limes, he was willing to cancel that stipulation.

The Secretary said he regretted that nobody would touch those lands. He had visited the lands along with some members and they were unanimous that those lands were the worst on the estate—entirely unsuitable for growing ground provisions. The land offered was worked two or three years ago and was now a piece of 'lastrajo', and beyond a crop of corn in the first year, they could get nothing else there. They were not scientists, but they thought the land required rest. They were in a difficult position—they had asked the Government for lands, and having got it, they would not touch it. They should not remain passive, but should tell the Government why they did not accept the land, otherwise, they would be branded as lazy good-for-nothings. He moved that a letter be sent to the Director pointing out the unsuitability of the land offered and that lands at 'Canal' and 'Cameron Hill' are better suited for ground provisions. In seconding this motion Mr. Cuthbert said he understood that the Manager of the estates had himself selected 'Canal' for his own garden. If 'Cascade' was so good, why does he not make his garden there? He hoped that nobody had misled the Governor about the grant of this Cascade lands. He desired to express the society's most grateful thanks to His Excellency the Governor for the very prompt manner he had dealt with their application for this land, and hoped if possible His Excellency would be pleased to offer at a pepper-corn rental lands at 'Cameron Hill' or 'Canal'.

After going through other business, the meeting terminated.

AGRICULTURAL CREDIT IN DEMERARA.

Judging from the first report of the Loan Banks Committee on the working of Co-operative Credit Banks in Demerara, the movement is making successful progress in the neighbouring colony. Three banks started work shortly after registration, and at the close of the year 1915 their subscribed capital stood at \$611.23. During the year 1916 fifteen additional banks were registered, bringing the number at work at December 31, 1916, to eighteen. At registration the subscribed capital of the eighteen banks stood at \$2,500.71, and at the close of 1916 the paid-up capital had increased to \$7,133.94. These figures indicate an increase in capital between the dates of registration and December 31, 1916, of \$4,633.23. During the year thirteen banks applied and obtained loans amounting to \$4,883. Government loans are repayable in twenty-five equal annual instalments with interest at the rate of 5 per cent. Due provision has been made by all borrowing banks for the repayment of capital and interest due to the Government. Most of the loans borrowed by shareholders have been used for working up cane, rice and provision crops. The period of loans ranges from three to eleven months. The borrowers have been, on the whole, punctual in repaying their loans. Of 2,238 shareholders at December 31, 1916, 1,656 are of the black race and 460 are East Indians. These figures go to show that members of the black race are giving most encouraging support to the banks established in the different village centres. The Banks' Committee can safely report that an encouraging start has been made, and that the year's work has done much to familiarize the masses of the colony with the aims, objects and utility of Co-operative Credit Institutions.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number deals with the principles of education in which consideration is given to the relative importance of science and literature.

Government assistance in regard to motor ploughing is referred to on page 163.

Two important articles on the Dominica green lime trade, and on research and the British cotton industry appear on pages 171 and 173, respectively.

Insect Notes in this issue describe control measures against the Mediterranean fruit fly in Hawaii.

Fruiting of the 'Male' Papaw.

It is a well-known fact that the male and female flowers of the papaw are usually produced on separate trees, and that occasionally flowers possessing both characteristics (hermaphrodite flowers) arise in female inflorescences. It has been further stated (*Agricultural News*, Vol. XII, p. 25) that a 'male' tree can be caused to bear female flowers, and eventually fruit, by cutting it back; and a summarized description given from details contained in *L'Agriculture Pratique des Pays Chauds* for October 1911, of the ordinary male and female flowers and the hermaphrodite flowers, and the differentiating characteristics pointed out.

In a recent number of the *Queensland Agricultural Journal* (April 1914) reference is made to the fruiting of the 'male' papaw in that Province, which is in confirmation of the fact that by lopping off the top at an early stage of growth, the male papaw tree is made to produce large quantities of fruit. It is stated that although the male papaw very rarely produces fruit in the Southern portion of Queensland, it is by no means a rarity to see in the Northern districts, especially in the rich lands about Cairns, male trees bearing dozens of fruits which are produced at the end of the long flower-stems, and dangle like a number of bells from the top of the tree. In illustration, an excellent photograph is given of a male papaw fruiting. When this tree was about 3 feet high, the sprout on the top was pinched off, with the result that it threw out several branches. About three months later it bore a few fruits, and recently, when eighteen months old, it began to bear abundantly, having on February 2 over 100 fruits on each branch. The same process was tried with other trees, but up to the date mentioned only a few papaws had appeared.

Purchase of Rhodesian Maize by the Imperial Government.

The *Rhodesia Agricultural Journal*, for February 1917, has authority for stating that the British South African Company has been able to effect an agreement with His Majesty's Government whereby the latter will accept, at the price of 10s. 6d. per 203 lb. gross, any quantity of the 1917 crop of maize, grades 1 or 2, offered f. o. r., at any station in Southern Rhodesia. His Majesty's Government will find freight. No guarantee as to quantity is required, nor does the arrangement bind anyone to deliver maize to His Majesty's Government at the price named, but secures two advantages, namely, a firm market for all surplus, and freight. The announcement of this arrangement was made through the press and by other means as well. The farming community as a whole welcomed the news, and although the planting season was already far advanced, it is known that as an immediate result and a tangible proof of appreciation, a considerable additional acreage of maize was at once planted.

The question has been raised as to how the prospective surplus can be measured. Obviously export must commence before the sum total of the crop can be ascertained. At first an estimate of the whole crop can only be approximately forecasted, and as the season advances the original figures can from time to time be

amended and the amount available for export assessed. As yet the amount of the surplus is problematical and depends on how the season continues, although, the Journal observes, 'at the time of writing everything points to an extremely good crop.'

Regret is expressed that the Imperial Government did not discriminate by a difference of price between grades 1 or 2. This, it is suggested, is doubtless owing to their being no occasion for such distinction, in view of the uses to which the maize is likely to be put for military purposes. Moreover, it is also possible that the Imperial Government might use grades 1 and 2 for different purposes and so introduce the Rhodesian maize to new markets—an advertisement which would stand the Colony in good stead in years to come. Rhodesia produces maize of very exceptional quality, and it seems right that they should emphasize and make the most of its special merits.

A further benefit accruing to the Colony from this agreement, it is stated, is the advertisement thus obtained of its ability to produce maize, and a recognition of Rhodesia as a source of supply, which will prove of lasting value to them in the world's markets when normal conditions return.

The British Guiana Lime Juice Factory.

The working of the Government Lime Juice Factory at Onderneeming, for the half-year, July to December 1916, is described by Mr. S. H. Bayley in a recent report. The factory is modelled after the St. Lucia one, which has now been working for several years, and from the report under notice it would appear that its operation will be accompanied by similar success to that which has attended the St. Lucia factory.

For an account of the St. Lucia factory reference should be made to the Reports on the Agricultural Department, St. Lucia, 1913-14, 1914-15 and 1915-16. A statement regarding the results for 1915-16, appears in the *Agricultural News*, Vol. XV, No. 375, pp. 294-5 (September 9, 1916).

The total capital outlay on the Onderneeming factory has been \$3,093. The transactions for the half-year show a profit of \$665 on a turn-over of \$2,980, which is over 20 per cent. The high price of £30 per pipe was obtained for the concentrated juice. The juice was reported on by the factory's London Agents as 'Special Quality.'

The limes purchased by the factory amounted to 1,605 bags (of 160 lb.) for which \$1,154 was paid. There appears to be no system of deferred payment in this Onderneeming factory as there is in the St. Lucia one.

As to the working of the Onderneeming factory, the following points may be of interest: *Juice extraction*.—This was at the rate of 7.82 gallons per barrel compared with 8 gallons per barrel in St. Lucia. *Concentration*.—This ranged from 98 to 110.8 oz. per gallon compared with an average of 107 in St. Lucia. *Sediment* was 1½ c.c. in 50. (St. Lucia, 2½-3 in. 100, second season's working.) *Distilled oil*.—This was 56 oz. per 100 gallons of juice compared with 80 oz. per 100 gallons of juice in St. Lucia.

It is stated that the reason for the somewhat low results is to be found in the quality of the fruit, which was rather inferior. Not only were the fruit in many cases totally unripe, but the presence of scale insects and sooty mould showed that the trees had been much neglected. Growers should bear in mind that the success of the factory must ultimately depend upon the regularity and quality of the supply of fruit.

The report under notice shows, however, beyond all dispute, that the St. Lucia type of lime juice factory with its improved milling and steam-coil concentration can be relied upon to turn out first-grade lime products efficiently and cheaply, while serving at the same time a highly useful purpose from the growers' point of view.

Jamaica Sugar Industry Development.

The following extract is from the Minutes of the Legislative Council of Jamaica, under date April 5, 1917, recording the Council's thanks for, and appreciation of the services of the Imperial Commissioner of Agriculture in connexion with his recent visit to Jamaica for the purpose of advising the Government in the matter of developing a sugar industry in the Colony:—'Mr. Simpson moved, seconded by Mr. Stedman, the following resolution which was carried unanimously:—

'This Council hereby records its sincere thanks for, and grateful appreciation of the untiring efforts of Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, to place before the Government of this island a sound, workable and business scheme for the re-establishment and support of our sugar industry, and for his proposals as placed before this House: And that a copy of this resolution be forwarded to Sir Francis Watts.'

The Production of Onion Seed.

The production of onion seed is a matter of interest in the West Indies where, so far, it has not been possible to effect. In Rhodesia, however, as in most sub-tropical countries, there is no difficulty experienced, and according to the *Rhodesia Agricultural Journal* for February 1917, the following is the method employed:—

'Practically all the onion seed used in this country is imported, and prices vary from 16s. to 33s. per lb. The question of growing our own seed is worthy of attention. This can be done as follows: A number of the cured bulbs are kept over for planting in December. Furrows are made about 5 inches deep and from 1½ to 2 feet apart, in which the bulbs are planted every 6 inches.

As the seed ripens the seed pods and the ends of the stalks turn yellow, and very frequently the pods burst open. When this occurs, the heads should be cut off and allowed to dry. If the ripening is uneven, the seed heads must be picked over several times. The seeds, after being thoroughly dried, are then cleaned and winnowed. The final cleaning may be done by immersing in water, when the light, useless seed will float on the surface and can be removed. The heavy plump seed should again be thoroughly dried before being bagged for the market.'



INSECT NOTES.

CONTROL MEASURES AGAINST THE MEDITERRANEAN FRUIT FLY IN HAWAII.

The Mediterranean fruit fly (*Ceratitidis capitata*, Wied.) has for many years been known as a pest in the Mediterranean countries, in different parts of Africa, in Australia, and in Bermuda. It is only within recent years that it has become established in the Hawaiian Islands, and in 1915 it was reported from Madagascar for the first time. This insect is best known as a pest of citrus fruits, but it also attacks a number of other fruits of economic importance, in addition to many species of uncultivated plants.

Ceratitidis capitata gained entrance into Hawaii from Australia probably about 1907, and at the time of its discovery in 1910, was found to be pretty well established. It spread rapidly, and at the present time it is known to be prevalent throughout the more important islands of the Hawaiian group. Its host plants in those islands now number upwards of seventy, and it has practically stopped the growing of all fruit except pine-apples and bananas, and a few mangoes and avocado pears. The Chinese banana is immune in the green stage, since neither the eggs nor the larvae of this fly can survive the tannin-laden peel of green though mature fruit. Even ripe bananas are not especially attractive as hosts under Hawaiian conditions. It is now considered by Back and Pemberton that with proper inspection and removal of any prematurely ripe, cracked or partially decayed fruits, there can be no danger in exporting bananas, provided that the bunches are packed in accordance with the demands of the trade and the Federal regulations.

The ability of this fruit fly to exist in many wild fruits as well as cultivated varieties makes it a particularly difficult pest to control, and its eradication becomes a practical impossibility when once it has become established in a country where its wild host plants abound.

So far it has been kept out of such citrus-growing countries as California and Florida by the most rigid inspection which has frequently intercepted fruits from Hawaii infested with the maggots of this fruit fly. The conditions both in California and Florida would seem to be far from ideal for the establishment of *Ceratitidis capitata* in those countries, since the unsuitability of the climate, the comparative scarcity of its wild host plants, and the well organized inspection service would all militate against its spread, even supposing that it gained an entrance.

In Hawaii the fruit fly had everything in its favour for the first few years until it was detected, but its discovery led to the adoption of a systematic campaign against it, and it may be of interest to give some of the main features of the war which still continues without ceasing.

CONTROL MEASURES.

As soon as it was discovered that the Mediterranean fruit fly was present in Hawaii, the local Board of Agricul-

ture recommended clean cultural methods, which included the collection and burial of all fallen fruit, but these measures gave little relief.

A number of experiments were made by H. H. P. Severin and H. C. Severin to discover the relative attractiveness of various animal and petroleum oils, but it was found that practically only male flies were taken by traps baited with many different oils. Further trials with kerosene, the most attractive of these oils, showed that out of every thousand fruit flies caught by kerosene traps only three were females. Kerosene traps, therefore, were a failure as far as the control of this pest is concerned, since it is essential to destroy the egg-producing females.

POISONED BAIT SPRAY.

The Mally poisoned bait spray, which has been used with good effect in South Africa, was tried extensively by the Severins. This spray consists of a mixture of 2½ lb. of sugar, 3-5 oz. of arsenate of lead and 4 gals. of water, which is sprayed on to the trees. The female flies feed greedily on this mixture, especially during the two weeks or so which elapse between their emergence and the beginning of egg-laying. This spray has met with some success, but can make but little headway against the enormous numbers of fruit flies which are constantly being bred in the wild guava and other fruits prevalent all over the mountains.

PARASITIC ENEMIES.

Meanwhile it had been decided to try and introduce some of the parasites which are so effective against *Ceratitidis capitata* in Africa and Australia, since a thorough search failed to reveal any parasitic enemies of this pest in Hawaii.

The success of Silvestri in introducing the parasites of the sugar-cane leaf-hopper into the Hawaiian Islands led Mr. Giffard, the President of the Hawaiian Board of Agriculture and Forestry, to ask him to search for the parasites of the fruit fly and introduce them into Hawaii.

Silvestri left in July 1912, and after visiting those parts of Africa where the fruit fly was prevalent, returned to Honolulu by way of Australia in May 1913. He brought with him from West Africa 300 specimens of *Galesus silvestrii* and 500 specimens of *Dirhinus giffardi*, both pupa-parasites, and a very few specimens of the larval parasites *Opius perproximus*, *O. humilis*, and *Diachasma tryoni*. These parasites were bred continuously during the journey, and on arrival in Honolulu were turned over to Fullaway and Bridwell. The two pupa-parasites, although received and subsequently liberated in large numbers, have apparently not yet become established, while two of the larval parasites *O. humilis* and *D. tryoni* have spread rapidly from a very small beginning. *O. perproximus* failed.

A subsequent expedition to West Africa by Fullaway and Bridwell resulted in the discovery and introduction into Hawaii of two more larval-parasites, *Tetrastichus giffardi* and *Diachasma fullawayi*.

There are now four parasites of the larval stages of *Ceratitidis capitata* established in Hawaii, and thousands of these parasites are being bred and liberated on the islands every month. The necessity of breeding such enormous numbers of parasites has led to the adoption of simple methods of rearing fruit fly larvae, so that all stages of the larvae may be available for parasitism.

It has been found by Back and Pemberton, who are conducting experiments connected with the biology and control of this fruit fly in Hawaii, that while all four species of parasites attack only the medium and well-grown larvae, three of them, *O. humilis*, *D. tryoni* and *D. fullawayi*, are most active in parasitizing the mature larvae while the host fruits

are still attached to the trees. *T. giffardi*, on the other hand, parasitizes larvae in fallen fruit to a much greater extent than any of the others, and it is thought that this parasite will prove most useful in supplementing the work of the other three species of larval-parasites. The data published by Back and Pemberton show that all four parasites have successfully established themselves and already promise to be an important factor in the control of *Ceratitis capitata* in Hawaii. These parasites have so far found conditions unusually favourable, with an abundance of hosts and apparently no natural enemies, and it remains to be seen how they will survive in the struggle for existence which will come later.

THE DOMINICA GREEN LIME TRADE.

With the object of improving the conditions pertaining to the transportation of green limes from Dominica, certain recommendations made by the principal shippers have been published in the *Dominica Chronicle* (April 28, 1917). The recommendations were formally submitted by the Chamber of Commerce to the Government, and the idea is that every shipper shall be made to conform to these suggestions. The Chamber of Commerce states first of all that they are not satisfied with the conditions prevailing at present in the green lime industry. In the interest of the trade the best means of preventing the exportation of bad, immature, and ripe fruit, would be to suggest to all shippers that a packing card with the name of the shipper, steamer, packer, and wrapper, also date of shipment be inserted in each package, with space for the receiver to insert date of inspection in New York. It is suggested that any complaints should be reported to the Chamber of Commerce who would make investigations on receipt of such complaints.

It is regarded as being very important that the limes should be graded. In regard to the picking of the fruit, it is suggested that clippers should be used, instead of the fruit being torn from the trees.

Shippers should avoid leaving the packed limes in the sun or rain, nor should they cover the packages with tarpaulins several days before the limes are shipped. The fruit should be stored in a cool and dry place pending the arrival of the steamer, and all limes should be allowed to cure for at least forty-eight hours before they are wrapped and packed. The question of using a trade mark is raised by the Chamber of Commerce; also the possibility of irrigating certain fields with a view of forcing the fruit at a time when the demand is greatest. It is recommended that in order that the fruit may have a bright clean skin, potassic manure should be used when obtainable.

Lastly, in view of the fact that the packages of green limes often arrive in New York in bad order, longer nails should be used for the cooping of the barrels.

A reference to the future of the Dominica green lime trade with New York will be found in the *Agricultural News* for March 10, 1917, p. 73.

SOIL PROTOZOA AND SOIL STERILIZATION.

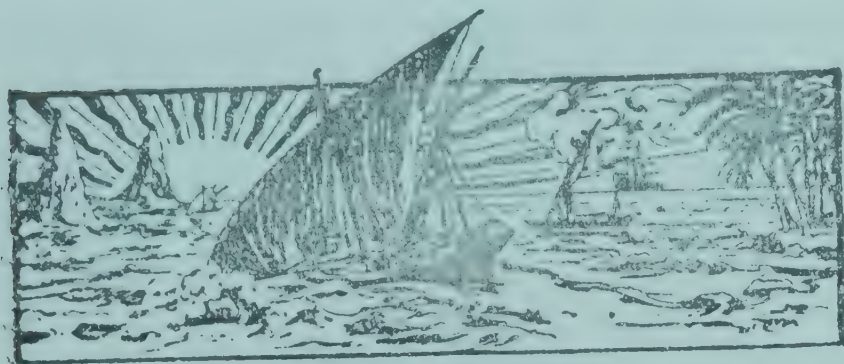
An exhaustive review of investigation in soil protozoa and soil sterilization, by N. Kopeloff and D. A. Coleman appears in *Soil Science*, (Vol. III, No. 3). It is held that Russell and Hutchinson's contention that sterilization eliminates a biological factor (protozoa, which are supposed to feed upon beneficial soil bacteria), has not been accepted by the majority of investigators working along the same lines. Reference is also made to Koch's theory of direct stimulation, Hiltner and Störmer's theory of indirect stimulation, Pickering and Schriener's chemical explanation of the problem and Greig-Smith's bacterial toxin hypothesis, all of which require, in the opinion of the reviewers, more investigation before any one of them can be accepted in an unqualified manner.

It is believed by the reviewers that the scope of unsolved problems in connexion with the subject is considerably broader than the investigations already carried to completion. How to sterilize the soil without altering its chemical composition is an important though baffling problem. On the bacteriological side, it is submitted, much can and needs to be done in determining the differences in the physiological efficiencies of the various groups of organisms in the soil and whether they are affected by sterilization. Further, it is imperative to know what rôle the fungi play in soil fertility, and how they may be taken into consideration when it is desired to have bacteria or protozoa constitute the limiting factor. Finally, a matter demanding immediate study is the actual observation of pure cultures of protozoa acting singularly and collectively upon pure cultures of bacteria, thus furnishing some definite basis for the investigations of soil protozoa as a factor in soil fertility.

Studies on Heated Soils.—In the *Experiment Station Record* (Vol. XXXV, No. 8) is a note on the results of experiments conducted at the University of Wisconsin with the object of investigating the effect of heated soils on plant germination and growth. Most of the seeds experimented with were found to be susceptible to the injurious action of highly heated soils. The action appears to be dependent particularly upon the content of organic matter in the heated soil. Different soils gave markedly different results upon heating to the same temperatures, but the extent to which the plant is effected depends upon the degree to which the soil is heated. Approximately 250° C. was found to be the most critical temperature in all the soils used. At this temperature seed germination was most strikingly retarded. It is interesting to learn that the ammonia content of the soil increased proportionately to the temperature of heating up to about 250°. The increase in ammonia was accompanied by a decrease in nitrates, which were practically non-existent in the highly heated soils. It is still more interesting to find that the percentage of seed germination was closely correlated with the amount of ammonia present in the heated soils studied. The amount of ammonia required to injure germination however, appears to vary with the type of soil when comparison of different heated soils are made. The beneficial action of heated soils on later plant growth, especially soils heated between 150° and 250°, is believed to be due in a large part to the direct assimilation of ammonia and ammonia compounds by the plants.

The above facts are not without interest in those parts of the West Indies where periods of drought occur causing the soil to be subjected at the surface to high temperatures during the day.

The St. Vincent Government Cotton Ginnery is now offering for sale at 5c. per lb., selected and disinfected Sea Island cotton seed of excellent germination. The cotton from which the seed has been obtained has been specially bred from a single plant by the Agricultural Department. It is of good ordinary grade, very even and fine.



GLEANINGS.

The *Experiment Station Record* (Vol. XXXV, No. 8), makes reference to a paper dealing with the branching and flowering habits of cacao and patashte, by O. F. Cook. The results are given of field studies of the characters and habits of the cacao tree (*Theobroma Cacao*) together with the related food tree *Triboma bicolor*.

The advertisement in *Nature* of intensive electro-horticulture for rapid food production is a sign of the times. Until recently the use of radium and electricity in the cultivation of crops has not made much headway. Those who are interested in electro-horticulture may obtain full particulars by writing to H. W. Cox & Co., Ltd., 159, Great Portland Street, London, W.

In Rhodesia the Management of the Salisbury bacon factory has decided to revert to the original prices formerly offered for bacon pigs. In the *Rhodesia Agricultural Journal*, for February 1917, it is stated that the prices are now as follows: first class bacon pigs 4½d. per lb. live weight, second class bacon pigs 4d. per lb. live weight, delivered at the factory Salisbury.

The need for further experimental work with palm kernel cake and meal as foodstuffs is referred to in the *Colonial Journal*, for April 1917, but it is also pointed out that the import of this produce from West Africa has been disappointing owing to the difficulty of obtaining tonnage to Hull, the great oil-crushing centre. It is added, however, that a considerable quantity has been sailed to Hull from Liverpool.

A note appears in the *Proceedings of the Agricultural Society of Trinidad and Tobago*, for February 1917, to the effect that members of that Society in common with agriculturists throughout the West Indies have greeted with sincere pleasure the news of the new honour conferred by His Majesty upon the Imperial Commissioner of Agriculture, and heartily congratulate him upon this well-merited distinction.

Notwithstanding the disease which has been causing loss amongst cacao in Ecuador, the crop for 1916, says the *Proceedings of the Agricultural Society of Trinidad and Tobago*, exceeds that of the previous year, being 98,054,892 quintales against 71,378,503 quintales in 1915. It will be remembered that Guayaquil cacao fetches the highest price on the London market, possessing certain special properties in regard to strength and aroma which put it more or less in a class by itself.

Until recently it would appear that no experiments have ever been carried out regarding the action of purgatives on the camel. A recent pamphlet issued by the Government of the Punjab contains an account of recent experiments conducted in that Province, and the results show that of all the purgatives tried, the best for the camel is magnesium sulphate; the others come in order as follows: kamala, croton oil, aloes, gamboge, and linseed oil. To produce purgation in the camel as much as 1½ to 2 lb. of magnesium sulphate has to be given.

Yields from the destructive distillation of certain hardwoods is the subject of Bulletin No. 508, contributed from the Forest Service, United States Department of Agriculture. The average yields of pyroligneous acid, tar, and charcoal expressed in pounds per cord are given, and it is noticed that Eucalyptus is particularly rich as regards its yield of these substances. As well as Eucalyptus, California black oak showed high yields of crude liquor per cord, and also gave high yields of acetic acid and alcohol.

A very instructive paper was recently read before the Royal Society of Arts by Sir C. Pardie Lukis, Director-General, Indian Medical Service, on Opportunities for Original Research in Medicine in India. In the discussion following the reading of the paper, Sir Patrick Manson suggested that more use should be made of native Indians in the matter of the prosecution of medical research. It will be remembered that some of the most important work on malaria was carried on in India, in connexion with which the name of Sir Ronald Ross is closely associated.

Published in the St. Lucia *Government Gazette* for March 7, 1917, is a draft amendment of the Agricultural Credit Societies Ordinance 1915. It is suggested that section 8 of the principal Ordinance should read: 'The number of members of a Society may, however, in special cases, be increased to such number as the Governor-in-Council may deem advisable.' It is also proposed to give the Governor power in Council to regulate co-operative operations, and other matters incidental to agriculture such as co-operative purchase and distribution of implements and manures.

A Committee consisting of Professor J. B. Harrison, C.M.G., the Hon. B. E. Brassington, and Messrs. A. A. Thorne, F. R. and C. J. Maggs, has been appointed to consider and report to the Demerara Government with respect to a recommendation made by the Flour Substitute Committee that a sum of \$15,000 be provided annually for the erection and carrying on of a factory or factories for converting raw vegetable products into non-perishable and marketable products and placing them in the market. (*The Barbados Agricultural Reporter*, May 25, 1917.)

During the nine months ended December 31, 1915, the pests proclaimed during the year in Trinidad were: locusts, rhinoceros beetle (*Strategus aloeus*, L.), and gru gru beetle (*Rhynchophorus palmorum*, L.). Seventeen notices relating to parasol ants (*Atta cephalotes*) were served during the year, and 393 large nests destroyed on Crown lands. Several of the very badly infested areas have received careful attention. In some places collections of very large nests were found within a small area, indicating that for some years no efficient steps had been taken to destroy them. (*The Review of Applied Entomology*, Series A, March 1917.)

RESEARCH AND THE BRITISH COTTON INDUSTRY.

At the end of July of last year, at the instance of the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research, a meeting of representatives of some of the larger firms engaged in the various branches of the cotton trade and others interested in Textile Research was called by the Lord Mayor of Manchester to consider the possibility of establishing a scheme for the scientific investigation of the various problems presented by the cotton-using industries; and it was agreed that there is great need for research bearing on the cultivation and manufacture of cotton, and in the dyeing, printing, bleaching, and other finishing processes. It was also thought that efforts should be made to increase and to improve the system of textile education. At an adjourned meeting it was decided that some practical steps should be taken to organize a complete scheme for these two purposes. A Provisional Committee was appointed and this, in due course, was constituted a Committee of the Advisory Council of the recently formed Government Department of Scientific and Industrial Research.

This Committee is largely representative of the various interests concerned. Its function is to formulate a preliminary scheme of a comprehensive character and to report to the Advisory Council; and then to lay before the trade, for its consideration, definite proposals for the establishment of a Research Association, eligible for recognition by the Government Department and consequently for monetary grants from the National Exchequer.

The Provisional Committee consists at present of the following members: Mr. J. W. McConnell (Fine Cotton Spinners' Association, Ltd.), Chairman; Mr. H. R. Armitage, (Bradford Dyers' Association, Ltd.); Dr. W. Lawrence Balls (Late of the Khedivial Agricultural Society of Egypt and the Egyptian Ministry of Agriculture); Messrs. T. D. Barlow (Messrs Barlow and Jones, Ltd.); F. W. Barwick (Manchester Chamber of Commerce Testing House); Stanley Bourne (Cotton Doubler, representing the Nottingham Chamber of Commerce); Lindsay Cropper (Messrs. J. & P. Coats, Ltd.); Henry P. Greg (Messrs. R. Greg & Co.); J. C. M. Garnett (Manchester School of Technology and the University of Manchester); A. E. Hawley (Dyer, representing the Leicester Chamber of Commerce); Forrest Hewit (Calico Printers' Association, Ltd.); E. L. Hoyle (Messrs. Joshua Hoyle & Sons, Ltd.); Alfred J. King (Bleachers' Association Ltd.); Kenneth Lee (Messrs. Tootal Broadhurst Lee Co., Ltd.); J. H. Lester (Late of the Manchester Chamber of Commerce Testing House); James Prestwich (Federation of Master Cotton Spinners' Association); Fred. J. Smith (British Cotton & Wool Dyers' Association, Ltd.); and Charles H. Turner (Cotton Spinners' and Manufacturers' Association). Mr. A. Abbott, H.M. Inspector of Technical Schools, has been appointed by the Advisory Council, with the concurrence of the Board of Education, to act as Secretary *pro tem*.

The Provisional Committee are holding fortnightly meetings.

They have to consider the place for Research in each branch of the cotton industry, whether in the cultivation of cotton, in spinning, doubling, manufacturing, knitting, lace-making, bleaching, dyeing, printing, finishing, or in the technology of cellulose. They have also to ascertain what facilities now exist for the education of boys entering any of these branches, and what opportunities are likely to be offered by the trade for the employment of highly trained

men. To complete their labours they will have to formulate a scheme both for an Institute to undertake research work in collaboration so far as practicable with existing bodies, and for an Association of firms and individuals willing to make donations and subscribe regularly for a period of years to promote research and improve technical training.

The terms and limitations under which the Association can obtain its share of the million pounds granted by the Treasury to promote Scientific and Industrial Research will be ascertained by the Provisional Committee.

Any suggestions relating to the researches to be undertaken or to any other matters coming within the scope of the proposed Association will be welcomed by the Committee, and should be sent to the Secretary, Provisional Committee on Cotton Research, 108, Doansgate, Manchester.

REQUIREMENTS OF THE RICE PLANT AT DIFFERENT STAGES OF GROWTH.

The food requirements of a plant at every stage of its growth are not the same. At one period, for instance, it will need potassium much more than at another. This is particularly so with rice. Hence the investigations of Mr. Jatindra Nath Sen, M.A., of the Agricultural Research Institute, Pusa, India, into the assimilation of nutrients by the rice plant are important and help us in connexion with manuring. The following is the summary taken from Bulletin 65 (1916) of the Institute. It may be mentioned that nearer home in Porto Rico the ash composition of Upland rice has also been studied:—

The total dry matter in a rice plant increases up to the time of maturity, the largest increase in the weight of the crop occurring however before the formation of the flowers.

The percentage of nitrogen generally exhibits a steady and continuous decrease from the first to the last period of growth, the most rapid decline being noted in the second period. In the roots, there is a very slight rise during the last stages.

Phosphoric acid content of the above-ground parts remains practically the same except in the first stage and during the flowering stage when it is slightly higher. In the roots, there is a very slight but regular decline maintained through all the stages.

The percentage of potash in the above-ground parts increases from the first stage to the preflowering stage, from hence forward there is again a decline. In the roots it is the same in the first two stages, after which there is a continued fall.

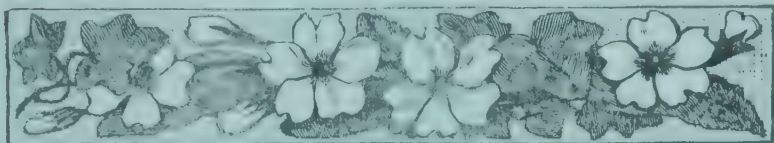
As the ears form and mature there occurs a concentration of nitrogen, phosphoric acid and potash in the grains at the expense of the other parts of the plant.

The assimilation of nitrogen, phosphoric acid and potash by the plant is fairly complete by the time flowers appear. Hence enough plant-foods must be available for the plant during the early stages.

There does not happen any migration of the absorbed nitrogen and potash back into the soil.

When there is a yield of 900 lb. dry grain, the soil suffers a depletion of 29.33 lb. nitrogen, 9.64 lb. phosphoric acid and 49.69 lb. potash per acre by the removal of the grains and straw.

The feeding values of the parts of the rice plant at different stages of the growth have been determined.



RECENT PLANT IMPORTATIONS.

The following is an account put together from statements appearing in the Reports on the Agricultural Departments of St. Vincent, St. Lucia, Dominica and Antigua for 1915-16, of the new plants introduced during that year into the different islands.

ST. VINCENT.

Seeds of the Tung or China Wood Oil plant (*Aleurites Fordii*) were received from the Imperial Commissioner of Agriculture and several seedlings were raised.

A collection of beans largely consumed in the Amazon region, and a number of improved varieties of Lima beans were also received from the Imperial Commissioner. The results obtained with these are reported on under the head Experiment Station.

Dolichos Hoseii, a strongly growing legume used for green-dressing purposes from the Federated Malay States was another importation.

From the Agricultural Superintendent, Antigua, a supply of the Barbuda white Lima bean (*Phaseolus lunatus*) was obtained for experimental planting.

The Imperial Commissioner supplied a sample of Argentine Indian corn (maize) as sold at Barbados. The corn was bolder and brighter than the ordinary native unselected St. Vincent corn.

From the Forest Officer, Trinidad, seeds of the Burmese Bamboo (*Cephalostachyum pergracile*) were received, but unfortunately the seeds failed to germinate, as did also seeds of *Juniperus cedrus*, received from the Imperial Commissioner.

A collection of water-lilies from the Royal Botanic Gardens, Kew, was received and planted out.

ST. LUCIA.

Seeds of *Kokia Rockii*, an interesting plant closely related to the cotton plant, and a native of Hawaii, were received in April. Four plants have been raised and at present they appear to be thriving, being a foot in height and making strong growth.

Six plants of the Mangosteen (*Garcinia Mangostana*) were obtained from the Curator, Botanic Gardens, Dominica; this will enable this delicious Eastern fruit to be planted in various parts of the island with a good chance of its becoming established and so forming a valuable addition to our present collection of fruits. Plants of three new varieties of grape-fruit were raised during the year from budwood received from the Botanic Gardens, Dominica, viz: Pernambuco, Mark's Seedless, and Manville's Improved. Plants were also raised of the Portugal orange from budwood received from the same source.

Two new varieties of mangoes—Tamancha and Madame—were received from the Agricultural Department, Trinidad.

A considerable number of interesting economic and decorative plants have been introduced during the year. The following are amongst the more important:—

Marking Nut (*Semecarpus anacardium*). The juice of this is mixed with quicklime and then used for marking linen.

Jak-fruit (*Artocarpus integrifolia*). A large tree, native of South India, bearing very large fruits often weighing over 100 lb. each. This fruit forms a very

important article of food with the natives and is relished by many Europeans.

Bilimbi (*Averrhoa Bilimbi*). A small tree bearing acid fruits 3 inches long; it is used in pickles and preserves, and makes excellent jam.

Honduras Mahogany (*Swietenia macrophylla*). Valuable timber tree.

Ceylon Spinach (*Basella alba*). A slender climber with succulent stems and leaves which may be used as spinach. It is extensively cultivated in Ceylon where it is relished by Europeans. This should prove a valuable addition to the vegetables of the island.

Brunfelsia americana. Ornamental shrub, yellow flowers.

Copaifera officinalis. Yields Copaiba resin.

Peltophorum ferrugineum. A handsome foliage tree bearing sweet-scented rusty yellow flowers.

Ficus nitida. Evergreen tree of Barbados.

Fig (*Ficus Carica*). A small spreading fruit tree, native of Turkey, known locally as the 'French Fig'.

Orchid Flower tree (*Monodora tenuifolia*). Profusely flowering tree bearing large orchid-like flowers.

Pandanus Baptistii from Dominica. Ornamental.

Cassia nodosa. A beautiful flowering tree bearing a profusion of bright pink and rose-scented flowers during May and June.

Norantea guianensis. A brilliant flowering shrub.

Bead tree. (*Adenanthera pavonina*). Produces bright scarlet seeds used for necklaces.

Albizia Lebbek, *A. procera*, and *A. stipulata* from India. Flowering shade trees.

Prosopis juliflora from India.

Camphor (*Cinnamomum Camphora*) from Japan; yielding by distillation of the leaves the camphor of commerce.

DOMINICA.

Twelve seeds of *Pouteria suavis*, a fruit of Uruguay, were received from the Kew Botanic Gardens. All the seeds germinated. Trials of this interesting species will be made in the Botanic Gardens, and in other districts of the island. It is described in the *Kew Bulletin*, No. 9, 1906, as being a splendid evergreen tree which bears a pear-shaped fruit having an extremely agreeable taste and possessing a finer scent than a ripe pine-apple.

Two plants of the Jaboticaba (*Myrciaria cauliflora*) were received from the United States Department of Agriculture, in exchange for seeds of the Mangosteen (*Garcinia Mangostana*). It is hoped that this, the favourite fruit tree of the Brazilians, will be found to succeed in Dominica. Mr. Wilson Popenoe, of the United States Department of Agriculture, writes of this tree as follows: 'Among the many interesting indigenous fruits of Central and Southern Brazil, few create so strong an impression on the new comer as the Jaboticaba, not only because of its habit of producing its delicious fruit upon the trunk of the tree from the ground, but also because of the unusual beauty of its symmetrical, dense, umbrageous head of light-green foliage, which entitles it to a place among the best ornamental trees of the region.'

To the collection of mango trees were added the varieties Haden and Mulgoba, which were obtained from the United States Department of Agriculture. Both are considered first-rate kinds, and it was desirable to import them for testing alongside selected Indian varieties already growing in Dominica.

As a result of the investigation now being made at Kew in connexion with the species of *Achras* which yield Chicle gum, seeds of an *Achras* from British Honduras were received through the Commissioner of Agriculture, and about 200 plants were raised. The value of the importation was at a later date somewhat discounted by the receipt of information showing that the seeds had been taken from young trees which had not been bled. It is intended, however, to grow a number of the seedlings for comparison with the common *Achras* of the West Indian islands. Meanwhile, now that it is known more than one species yield Chicle gum, further steps are being taken to obtain seeds of the kind known to yield the best quality gum.

A single plant of the Queensland Nut (*Macadamia ternifolia*) was raised from seeds received from the Botanic Gardens, Trinidad, during 1914. This has been planted out for trial.

No success has attended the efforts to establish the Brazil Nut (*Bertholetia excelsa*), in spite of repeated trials extending over a number of years. Recently a further supply of seeds has been received, and fresh attempts will be made to grow this tree. A similar difficulty has been expressed with the Sapucaia Nut (*Lecythis Zabucujo*).

The two trees of the Litchi (*Nephelium Litchi*), a species introduced sixteen years ago, grow well, but fruit only at intervals of five or six years. Other species of this genus which yield edible fruit are desired for the Garden collection.

ANTIGUA.

Some few plants of interest were received from various sources during the latter end of the period under review. Among these may be mentioned the African Mahogany (*Khaya senegalensis*), the Indian Olive (*Putranjiva Roxburghii*), and the Litchi (*Nephelium Litchi*).

Seed of the Litchi has several times been imported into Antigua, but efforts to raise the plants have never been successful. This is a celebrated Chinese fruit, and is said to possess a delicious sub-acid flavour.

Seeds of *Dolichos Hoseii* and *Juniperus cedrus* were received from the Commissioner of Agriculture, but no plants were raised from them.

Seeds of *Kokia Rockii* were received from the United States Department of Agriculture, and although they germinated well, the young plants died when about 6 inches high.

Seeds of *Indigofera sumatrana*, *I. longeracemosa*, *Mucuna* sp., *Crotalaria Mussaui*, *Clitoria cajanifolia*, and *Tephrosia Vogelii* were received from the Commissioner of Agriculture. These plants are useful for green-dressing purposes, and it is hoped that sufficient plants will be raised from each to give them a trial in Antigua.

The interesting plant *Ficus religiosa*, which was imported during the year 1912-13, is now making good growth and is between 5 and 6 feet in height.

Contributions of plants were received from the following: The Imperial Commissioner of Agriculture, the Botanic Stations at Tortola, St. Kitts, Nevis, Montserrat, St. Vincent, Dominica, and the Royal Botanic Gardens, Trinidad.

Plants and seeds were sent to the Botanic Stations at Grenada, St. Kitts, Nevis, Montserrat, St. Lucia; the Louisiana State University, Louisiana; U.S.A. Agricultural Department, St. Croix; the Botanic Department, Trinidad, etc.

THE HIGH PRICE OF SUGAR.

The following embodies a review (in the *International Sugar Journal*) of a recent pamphlet in which it is suggested that British cane-growing countries could produce more sugar per acre and thereby bring about a reduction in the price of sugar. The review contains interesting references to sugar production in Java:—

In 1914, before the war, there was every appearance of an abundant supply of sugar at a very moderate price. The excitement of the British Government when war broke out sent prices up to a very fancy figure, at which they succeeded in securing a million tons to go on with. Then prices went down again, so they prohibited importation and the consumer paid the piper. Violent fluctuations have taken place since then, followed by a scarcity of ships, which justified the Government in taking complete control of the supplies and the prices.

There does not appear to be any fear of high prices after the war. On the contrary, present high prices are stimulating an increased production of cane sugar throughout the world, and of beetroot sugar in the United States. We need not, therefore, search for means of increasing supplies in far-fetched ways. The only search of that kind is for sufficient production in the British Empire to make us, eventually, more or less independent in future of outside supplies.

There have been some curious imaginings as to whence the British supplies should come. The idea of getting a large increase from British Guiana by tapping the Hinterland of that large but almost unknown country is, at present, pure imagination. No one knows anything as yet of the capabilities of that remote land, but we do know that sufficient labour is not there, nor roads, much less railways.

Then some are speculating, like Mr. Harold Hamel Smith in a book, just published, on our being able, in some happy future to rival Java and Hawaii in their phenomenal crops, producing an average of more than 4 tons of sugar to the acre. It is to be feared that we shall not at present succeed in finding many spots in the world of Imperial Britain where such crops will rapidly appear.

Java is blessed in more ways than one with exceptional advantages. First, there is a good supply of labour, then there are excellent facilities for a large system of irrigation, which brings not only water but also a most fertilizing slime on to the land. Thirdly, the sugar is a rotation not a solitary crop. The canes are, therefore, all plant canes, never ratoons. The crops which intervene help to the fertility of the soil. To these natural advantages we must add great capability on the part of the Dutch planters which has brought the Java industry to an exceptionally high pitch of perfection. This has combined with nature to bring the cost of production down to a very low figure.

Hawaii has similar advantages as regards irrigation, which has been developed on a most generous scale, thanks to the large preferential treatment of sugar from the Sandwich Islands in the markets of the United States. No such violent stimulus has yet been applied to British sugar industries, but perhaps it may come, and then we may go ahead, not only, it is to be hoped, with energy, but also perhaps with sufficient intelligence and capacity to enable us to compete to some extent even with Java in the tropics and Germany in the beetroot industry.

But in any case let us avoid dreams and turn our minds to getting things done.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
April 19, 1917.

ARROWROOT—4½d. to 6½d.
BALATA—Block, 3/3½ to 3/5; Sheet, 3/8 to 3/11½.
BEESWAX—No quotations.
CACAO—Trinidad, 82/- to 85/-; Grenada, 65/- to 81/-;
Jamaica, no quotations.
COFFEE—Jamaica, 62/- to 63/-.
COPRA—£43 10s.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £21 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—1/3 to 2/-.
NUTMEGS—1/1½ to 1/6.
PIMENTO—4½d.
RUBBER—Para, fine hard, 3/1½; fine soft, no quotations
Castilloa, no quotations.
RUM—Jamaica, 4/9 to 5/3.

New York.—Messrs. GILLESPIE BROS. & Co., April
11, 1917.

CACAO—Caracas, 12¾c. to 12¾c.; Grenada, 12c. to 12¼c.;
Trinidad, 11¾c. to 12c.; Jamaica, 10½c. to 11¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$42.00 to
\$44.00; culls, \$28.00 to \$30.00.
COFFEE—Jamaica, 9½c. to 11½c. per lb.
GINGER—16¼c. to 20c. per lb.
GOAT SKINS—Jamaica, \$1.20; Antigua and Barbados, \$1.10
to \$1.15; St. Thomas and St. Kitts, \$1.00 to \$1.10
per lb.
GRAPE FRUIT—Jamaica, \$1.25 to \$1.75.
LIMES—\$5.00 to \$6.50.
MACE—37c. to 42c. per lb.
NUTMEGS—21c. to 22c.
ORANGES—87½c. to \$1.50.
PIMENTO—5½c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 6.27c; Muscovados, 89°, 5.75c.;
Molasses, 89°, 5.25c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., May 18,
1917.

CACAO—Venezuelan, \$12.00 to \$12.50; Trinidad, \$11.50 to
\$12.00.
COCO-NUT OIL—\$1.27 per Imperial gallon.
COFFEE—Venezuelan, 10c. to 11c.
COPRA—No quotations.
DHAI—No quotations
ONIONS—\$1.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$8.00 per 100 lb.
RICE—Yellow, \$10.00 to \$10.50; White, \$6.50 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., May 16,
1917

ARROWROOT—\$6.00 per 100 lb.
CACAO—\$13.00 per 100 lb.
COCO-NUTS—\$26.40 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure,
no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$8.50 to \$9.00.
PEAS, SPLIT—\$10.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$9.50; Patna, no quotations; Rangoon
no quotations.
SUGAR—Muscovado centrifugals, \$4.75 to \$5.00.

British Guiana.—Messrs. WIETING & RICHTER; Messrs.
SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND- BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



A FORTNIGHTLY REVIEW

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Electrical and Other New Methods of Increasing Plant Growth.

EVEN before the war much public and scientific interest was shown in connexion with attempts made to increase crop production by means of certain innovations (so far as agriculture is concerned) such as electric discharges, radium, humogen, and dynamite. Since the war, interest has increased

with the growing importance of intensive culture, and at the present time we are in a position to form a fairly accurate estimate of the practical value of these new devices for stimulating plant growth.

On account of their novelty, the experiments that were made at the beginning received rather more publicity and encouragement in the Press than the results, as a whole, really justified. This was especially so in the case of humogen, radium, and dynamite.

Humogen, it will be remembered, is a preparation of peat invented by Professor W. B. Bottomley, for which a remarkably high manurial or tonic action has been claimed. The substance is prepared by neutralizing the peat and then causing it to undergo bacterial decomposition up to a certain point, after which the mass is sterilized and inoculated with a culture of nitrogen-fixing organisms. The earlier horticultural experiments, notably those conducted at Kew and Wisley, in Surrey, showed that humogen undoubtedly can have a most remarkable effect on plant growth in pots; but experiments conducted out-of-doors and on a field scale gave inconclusive results, and the general conclusion that most people were soon inclined to accept, was that humogen can not be depended on to exert a positive effect on a field scale, and even if it could, the expense of the substance would make its general use prohibitive. Quite recently the results of the Rothamsted investigations as to the agricultural value of humogen have been published by Dr. Russell,* who states that in all cases humogen had no effect. Nor could any evidence be obtained to show that 'bacterization' adds to the value of the peat by way of producing 'plant accelerators' or 'plant auximones. Professor Bottomley has met these results by stating that he has discovered that the material sent to

**Journal of the Board of Agriculture (England and Wales)*, for April 1917.

Rothamsted was wrongly prepared. The whole story of humogen is unsatisfactory, except for the fact that impartial and carefully conducted experiments by other workers have failed to obtain the effects which its promoters claim for it.

In regard to radium or radio-active substances, which we may consider next, it was pointed out in this Journal† that a recent Bulletin‡, issued by the University of Illinois, gives the question of the manurial value of these substances general consideration. Upon careful analysis of known facts, the writer of the Bulletin comes to the conclusion that radio-active substances cannot be depended on to effect an increase in crop yields. We are scarcely prepared to dismiss the claims made for radio-active substances to this extent however, for, as we pointed out in a lengthy summary of the position in this Journal over a year ago,* experiments in at least four different countries have indicated that radio-active materials stimulate growth; the results of experiments with peas, for instance, have been remarkably uniform. The trouble seems to be the expense of the materials, and until the radium industry develops to such an extent that radio-active by-products appear on the market—substances like carnatite, for example—it is unlikely that radium will ever play an important part in the economic production of crops. Scientifically the subject continues to be of great interest, and it may be mentioned here that it is supposed that radium has the power to supply energy, which can take the place of sunlight, for the manufacture of sugar in the green plant.

The rôle of dynamite in crop production is, of course, entirely different to that of humogen or radium. Its action is on the soil direct, and is of a mechanical nature. It has been used principally in connexion with orchard crops with the idea of aerating the soil. The explosions are expected to form fissures in underlying rock, and to break up a hard-pan so that roots can extend, and water and air may circulate. The failure to obtain generally satisfactory results in the West Indies in the case of cacao, limes and bananas has probably been due to the fact that explosions have been made when the subsoil was saturated with water. The effect of the explosion under such conditions would be to consolidate rather than to disintegrate. In any case the value of dynamite as a soil improver cannot be said to be as great as the promoters and the Press would have one believe. It is unquestionably valuable in the clearing of forest land and in blasting hard rock that may

interfere with ploughing, but only in very special cases can it be expected to improve the air or moisture conditions in the subsoil.

The stimulation or speeding up of plant growth by electric discharges has been left till the last, not because it is of less interest or importance; on the contrary, it is the method which holds out greatest prospects of practical utilization.

The latest report on experiments is by Professor V. H. Blackman and J. Jörgensen, of the Imperial College of Science and Technology.* The experiments have been conducted principally with oats and clover, and have now been carried on for two years. The overhead discharge was applied by means of a series of wires about 4½ yards apart and 7 feet from the ground. The current applied was 3 ampères at 50 volts, but the intensity of the discharge received by the crop was much greater than in the previous year on account of the closed arrangement of the wires.

The investigators state that the effect of the discharge on the crop was shown within a month after germination, the treated plants being much higher and of a darker green than those in the control plots. Eventually the electrified area, as compared with the control area, gave an increased yield of 20 bushels (840 lb.) of grain and 2,305 lb. straw: in other words, the increase in grain was 49 per cent., and the increase in straw was 88 per cent.

'After making allowance for the large experimental error, it is clear,' the authors state, 'that oats under the conditions of these experiments respond very markedly by an increased yield both in grain and straw to the action of the overhead electric discharge.'

It is not possible at present to estimate accurately the financial results of the experiments. However, the increased value of the oat crop worked out at over £6 per acre. The cost of the current used was about 11s. The cost of an installation on a commercial sale cannot at the present time be predicted, but, as the authors point out, the profit shown above would permit of a heavy expenditure on an installation.

DEPARTMENT NEWS.

By a recent steamer Mr. G. A. Jones, Assistant Curator and Chemist of the Agricultural Department, Dominica, left for England to offer his services in connexion with the war. By the same steamer several planters having estates in Dominica also embarked for the same purpose.

†for May 20, 1916, p. 172.

‡No. 177.

*March 27, 1915 (Vol. XIV, p. 111).

*Journal of the Board of Agriculture (England and Wales), for April, 1917.

MOLASSES AS A FERTILIZER FOR CANE LAND.

In the course of the manurial experiments with sugar-cane in the Leeward Islands, a considerable amount of attention has been devoted to an enquiry into the possibility of usefully employing the waste molasses obtained in cane-sugar factories as a fertilizer for cane land. In the Report on this work for 1916-17, it is stated that the experiments had their inception as a result of similar trials in Mauritius. It has been suggested that benefit would accrue from applications of molasses made in this way, owing to the stimulation produced in the activity of soil-inhabiting bacteria of the *Azotobacter* type (which are capable of assimilating free nitrogen from the air), the presence of which has now been demonstrated in soils throughout the Leeward Islands Colony.

Experiments conducted on ratoon canes between the years 1908 and 1913 showed that little or no beneficial action resulted from such applications. In the following year, 1914, further series of experiments were laid out to ascertain whether such applications were likely to prove of benefit in the case of plant canes, since it was thought that the longer interval which would elapse between the time the molasses was applied and the date the canes were reaped, would give opportunity for any excess of nitrogen assimilated in this way to become available to the plant.

During the preceding season, 1914-15, series of experiments on these lines were conducted in duplicate on estates in Antigua and St. Kitts. During the year under review they have again been repeated at Brighton and Buckleys in St. Kitts, and at Parham New Work in Antigua.

The experiments form an adjunct to the main series of manurial trials with plant canes, and comprise the following, each in duplicate:—

- A. 200 gallons of molasses per acre
 - B. 400 gallons of molasses per acre
- together with the no-manure plots of the series which constitute the control.

The molasses was applied to the plots in St. Kitts on December 13, 1915, and to those in Antigua on March 2, 1916. The results obtained are given in tabular form below. Duplicate plots of each experiment were reaped at Brighton and Buckleys but only single plots at Parham New Work:—

	Number.	Tons of cane per acre.	Difference on No Molasses.
I.	No molasses		
	Mean of 12 plots	27.9	
II.	200 gallons of molasses		
	Mean of 5 plots	31.5	+ 3.6
III.	400 gallons of molasses		
	Mean of 4 plots	32.5	+ 4.6

It will be seen that on the present occasion the application of 200 gallons of molasses has increased the yield by 3.6 tons of cane per acre, while 400 gallons of molasses have increased the yield by 4.6 tons of cane per acre.

The means for both seasons follow:—

	Number.	Tons of cane per acre.	Difference on No Molasses.
I.	No molasses		
	Mean of 2 plots	21.8	
II.	200 gallons of molasses per acre		
	Mean of 1 plot	24.8	+ 3.0
III.	400 gallons of molasses per acre		
	Mean of 1 plot	25.5	+ 3.7

As the means of two seasons' work we find that applications of 200 gallons of molasses per acre have given an increased yield of 3.0 tons of cane per acre, while applications of 400 gallons of molasses per acre have given an increased yield of 3.7 tons per acre.

The results so far as they go, would appear to indicate that larger increases of yield may tend to follow the application of molasses to plant canes, thereby bearing out the idea with which these experiments were initiated.

It is however to be observed that, save in very exceptional circumstances, the employment of molasses in this way can hardly be regarded as economical, since it would appear far sounder business policy to utilize the irrecoverable residues of sugar for the production of alcohol.

At this present juncture when increased attention is becoming devoted to the utilization of alcohol as a source of heat, light, and power in internal combustion engines, it seems not improbable that a time may not be far distant when the complete utilization of such waste products in this way may receive the attention which it deserves in the Leeward Islands Colony.

SOLID- AND LIQUID-CAMPHOR TREES.

In a paper on essential oils submitted by Sir Francis Watts (*West Indian Bulletin*, Vol. IX, p. 275) it was stated that a small quantity of wood, and of leaves and twigs from the camphor trees growing in the Botanic Gardens at Dominica had been submitted for distillation and that no solid camphor was obtained nor could any be obtained by cooling in oil. In this connexion, the British Consul, in a report on the trade of Foochow, wrote in 1906:—

'It is said of the existing trees that a considerable number do not produce camphor. Some theorists assert that like the coco-nut palm, *Cinnamomum Camphora* grows to perfection only close to the sea. Others, that camphor trees are male and female, and that crystals of the desired quality are found in the male only. The theory is, however, scientifically inexact, since the flower of *Cinnamomum* is polygamous.'

In 1916, further experiments were made at the Government Laboratory, Antigua, when camphor wood from the Dominica Station, and leaves and twigs of a tree, nearly 100 years old, from St. Vincent were distilled. The results on this occasion confirmed those of the previous distillation, for no solid camphor was found.

As camphor trees grow well in Mauritius, and it was desirable to investigate the yield of camphor and camphor oils of the existing old trees before reforestation of the island with camphor was undertaken, investigations into the matter were made by the Agricultural Department, and the results showed that the camphor trees of Mauritius yield no solid camphor, and only small quantities of 'light' camphor oils.

Experience tends to show that the production of camphor or oil only is related to definite varietal differences, and it is interesting to learn that the Japanese can recognize at sight the camphor-producing or oil-producing trees.

According to the results obtained at the Imperial Institute in 1913, samples of camphor oil from the Federated Malay States were found to differ from ordinary camphor oil as now placed on the market, in that the camphor has not been separated and that they contained no saffrole, which is the characteristic and valuable constituent of the Japanese camphor oil of commerce.



DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. During the month of May, work in the Experiment Station was of a routine nature. Plant distribution totalled 456; in addition, 237 packets of vegetable seeds were sold. In regard to staple crops, Mr. Joseph Jones, the Curator, states that a good carême crop of cacao was gathered on estates along the Leeward coast. The local price paid for green limes dropped from 20s. to 8s. per barrel. Over 4 acres of coco-nuts were planted at the Experiment Station, the plants being presented by Messrs. Rowntree & Co. Twenty thousand lime plants were advertised for sale at the rate of 4s. per 100.

The cacao at the Botanic Gardens and on estates on the Leeward coast yielded heavily. The carême crop alone at the Gardens amounted to 30 bags of 200 lb. each, or at the rate of 800 lb. of cured cacao per acre. Yet the trees looked badly, there being many dead branches and dead tops. This, observes Mr. Jones, is to be expected after experiencing two hurricanes in thirteen months. How far the large crop was due to injury by the wind is not possible to state, but the high yields would appear to be of the nature of a dying effort, as it is known that diseased and severely shaken trees yield very heavily. On these grounds the rough treatment which the trees received in August last may account for the increase of yield. Manures should now be liberally applied in order to assist the trees to stand the strain of heavy bearing, and to restore them to good condition. Rainfall for the month was 2.94 inches. There were signs of the weather breaking at the end of the month after nearly three months drought.

ST. LUCIA. The Agricultural Superintendent, Mr. A. J. Brooks, reports that continuous drought during the month of May stopped all planting operations in the Experiment Stations. The work for the most part was of a general routine nature, excepting the making of farine and starch for local consumption. The following plants were distributed: lime plants 400, Julie mango 2, economic seeds 2,110 packets, economic cuttings 183, cassava cuttings 8,500, decorative plants 35, vegetable seeds 91 packets, ornamental seeds 6. It is added that 2,500 seeds of star apple were forwarded from the Botanic Gardens to Egypt. In regard to staple crops, cacao was flowering, limes flowering and fruit setting, and the sugar crop was finished. New areas were being cleared for planting lime trees. The Agricultural Officer visited Dennery district from the 8th to the 20th in connexion with the sugar industry; estates and small holdings in several districts mentioned were also visited. Special efforts are contemplated in connexion with the planting of ground provisions, should the rains set in. Rainfall for the month was, at the Botanic Gardens, Castries, 3.49 inches; at the Agricultural and Botanic Station, Choiseul, 1.10 inches.

NEVIS. The following information, which is a recapitulation of matters already supplied in the monthly reports for the period covered, is contained in the Report of the Agricultural Instructor, Mr. W. I. Howell, for the quarter ended March 31 last. Work in the Experiment Stations con-

tinued satisfactory; crops on several plots were all reaped and good returns obtained; the other crops were doing fairly well. Cotton in the demonstration plot was reaped and a return of 134 lb. of lint to the acre obtained. The old cotton was being pulled off and preparation for next crop had commenced. The onion crop was reaped during the latter part of the quarter and a return of about 6,000 lb. of onions obtained from the plot of $\frac{1}{2}$ -acre. The crop was handled by the Onion Growers' Association. The plot of castor seeds was doing fairly well, reaping had begun, but the returns from this picking would not be very good as the plants were not very large, having been put in only on December 28, 1916. A plot 1 acre in size was planted in sweet potatoes, one-half on 4-foot banks, 1 foot apart on the bank, the other half 1 foot apart on 4-foot banks and cross holes dug 4 feet apart between the banks, and two holes planted on each cross hole. The object of the experiment was to ascertain whether larger yields would not be obtained from closer planting. The plot, on the whole, was doing well but had been damaged several times by stock pastured on the adjoining fields.

The following plants, seeds, etc., were distributed during the quarter: sweet potato cuttings 9,850, Guinea corn 213 lb., Indian corn 30 lb., black-eye peas 8 lb., Lima bean 4 lb.; yams 354 lb., Para peas 34 lb., cotton seed 56 lb.

The cane crop, though not so good as last year's was still fairly good, and large yields were obtained in some places. A much greater proportion of the crop this year was sold to the St. Kitts Factory. The question of better transit of canes across to St. Kitts was being discussed and it was hoped that something would be done in this direction. The second growth of cotton throughout the island gave fairly good returns, the average yield being about 100 lb. of lint per acre. The old cotton trees were being pulled off and preparation made for next crop. It was estimated that no less than 3,000 acres would be put under cotton cultivation this season, but there might be some difficulty in handling the crop on account of shortage of labour. The onion crop throughout the island was a success. Over 36,000 lb. were handled by the Association, and the price in the local market continued good throughout the season. Shipmen's were made to New York, Barbados and Trinidad, where fairly good prices were obtained. The provision crops, on the whole, continued satisfactory, but on account of the high price of cotton there was a tendency to neglect the crop, hence special efforts were being made to induce the small growers to continue planting provision crops as in the past. The vanilla at Maddens estate continued to do well. The curing under glass proved quite a success, and better results were obtained from it than from curing directly in the sun. Mr. F. R. Shepherd, the acting Superintendent of Agriculture for the Leeward Islands, visited the island on several occasions during the quarter and advised on agricultural matters in general. The rainfall for the quarter was 7.24 inches.

The influence of the composition and concentration of the nutrient solution on plants grown in sand cultures is dealt with in the University of California *Publications in Agricultural Sciences* (Vol. I, No. 11, pp. 341-94). It is stated that flower yields in *Nicotiana* as well as vegetative vigour are influenced by the composition and concentration of the nutrient solution. From this, it would appear to follow that one of the advantages of manuring lies in the increased production of flowers. But it does not necessarily follow that all of these flowers will produce fruit. Hence the value of manuring should not be gauged by fruit yield alone.

THE PACKING OF EGG-PLANTS.

Although egg-plants are not generally grown for export in the British West Indies, it may prove useful for other reasons to give a few facts concerning the packing of this fruit, which appear in the Cuban monthly review, *Agriculture*. In this journal, which has only just recently made its appearance before the public, Mr. R. S. Cunliffe says that for packing, the regular egg-plant crate is used, and that in the best practice this is lined with paper previous to packing the fruit. The usual sizes are 18, 24, 30, and 36 fruits to the case, of which the medium sizes 24 and 30 are usually the best sellers, but this is said to vary somewhat with the market. Only thoroughly sound fruit in proper condition should be packed: every damaged or imperfect fruit in a crate only serves as a source of loss to the shipper out of all proportion to the value of the individual fruit or package.

During the past year some experimental work was carried out at the Cuban Experimental Station with the object of arriving at suitable systems of packing different sizes of egg-plant, and of correlating in some way the different factors of weights and dimensions with the corresponding numbers and sizes of fruit required to make a full pack.

Mr. Cunliffe groups varieties of egg-fruit into two classes: the Florida High Bush (long type fruit); and the New York Spineless (short type fruit). The first group vary in size from $18\frac{1}{8}$ inches in circumference to 13 inches, from $5\frac{3}{4}$ inches in diameter to 4 inches, and from $2\frac{1}{2}$ lb. in weight to 1 lb. This class is divided into four packing sizes as already mentioned, namely, Nos. 18, 24, 30 and 36. The New York Spineless is also classified into four packing sizes ranging from $18\frac{1}{4}$ inches in circumference down to 14 inches, and in length from $6\frac{1}{2}$ inches down to $5\frac{1}{2}$ inches. The Florida High Bush (long type) range in length from 9 inches to $6\frac{1}{2}$ inches. In weight the short type fruit varies from $2\frac{3}{4}$ lb. down to 1 lb. Thus the difference between the two varieties from the point of view of packing is chiefly one of length.

The method of arranging these sizes in the boxes is seen from the following:—

(a) Long Type fruit:

Size 18 pack, 3 layers of 6 fruits each.

„ 24 „ 4 „ „ 6 „ „

„ 30 „ 5 „ „ 6 „ „

(or) 30 „ 4 „ (1st and 3rd of 7 fruits each),
(2nd and 4th of 8 fruits each).

(b) Short Type fruit:

Size 18 pack, 3 layers of 6 fruits each

„ 24 „ 4 „ „ 6 „ „

„ 30 „ 5 „ „ 6 „ „

„ 36 „ 4 „ „ 9 „ „

At the conclusion of the article from which the above facts have been taken are a number of plates showing the egg-plants packed in position.

TRAINING AT THE DOMINICA GARDENS.

So successful has the course of horticultural training at the Dominica Botanic Gardens proved, that candidates who fail to be selected are now showing a desire to pay for the instruction themselves rather than go without the training. Even the year before last Mr. Joseph Jones the Curator, wrote in his Annual Report:—

‘There is quite a keen desire on the part of parents to have their sons trained at the Gardens and we are indebted to the head teachers of the country schools who bring to the notice of likely candidates the advantages of entering for training. On an average, twelve candidates present themselves at the competitive entrance examination annually. Many of these are hopelessly backward, and should not have been sent up by their teachers; but as a rule four or five are fairly good and three are finally selected. Preference is given to the sons of peasant proprietors.’

As to the ultimate destination of the pupils, Mr. Jones says:—

‘Having completed their two years of training the majority of the pupils leave the Department to take up positions on estates. The ideal position for such a boy would be that of under overseer on a fairly big estate: such a position he should be able to fill satisfactorily. It is too much to expect these boys to be able to do the work of a trained overseer, which involves considerable experience in various directions, more particularly in the handling of labour. This is probably the weakest point of their training, and the planter should regard them as material for making efficient overseers and be prepared to train them accordingly.

‘The most promising boy of each year is usually retained in the Department for another two years. During the first year he is appointed clerical assistant to the Curator, and the second year, if he continues to show promise is appointed overseer in connexion with agricultural instruction, and in that capacity is responsible for the field work of the other agricultural pupils. These additionally trained young men are naturally better equipped than the ordinary pupils, and should give better satisfaction.

‘It is interesting to place on record the destination of each pupil on leaving the Botanic Gardens, and though the Department is not responsible for them after they get a fair start on an estate, attempts have been made to trace the boys at the present time. This information is now given:—

‘G. de Lachevotier: Old Agricultural School boy. First overseer at the Botanic Gardens. Now overseer Agricultural Department, Northern Nigeria. Alexander Thorpe: Old Agricultural School boy, completed training as pupil, appoint-office assistant now in U.S.A. Harry Cuffy: Appointed overseer Canefield estate. Philip Denis: Appointed overseer Malgretout estate. Paul Benjamin: Appointed overseer, Somerset estate, last heard of in St. Lucia. Artley Frank: Appointed clerical assistant, later overseer Agricultural Department, now overseer Belfast estate. Wilfred Andrew: Discharged for not making satisfactory progress. Vincent Laronde: Appointed overseer Rosalie estate. Fadelle Lawrence: Appointed overseer Castle Bruce estate. Stanley Jules: Appointed overseer Goodwill estate. Emile Joseph: Appointed clerical assistant and now holds the post of overseer, Agricultural Department. George Anselm: Did not complete training; now overseer Bagatelle estate. Gorvey Cuffy: Left after twelve months training; now overseer Badineau estate. Musgrave Edwards: Discharged for lack of interest. William Hutton: Appointed clerical assistant, Agricultural Department.’

This useful educational work will suffer in the absence of Mr. G. A. Jones, the Assistant Curator, now left for war service, who was intimately associated with the work; but it is hoped that every effort will be made to carry on as well as possible



COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending May 19, 1917, is as follows:—

N. B.—By official recount of the Cotton Exchange the stock in Savannah was increased 1,102 bales, which was largely cotton held by exporters for shipment on contracts later on, leaving the unsold stock in Factors' hands unchanged.

ISLANDS. The market is closed for this season, as the crop has all been marketed and sold. The new crop (1917-18) will not come to market before October.

GEORGIAS AND FLORIDAS. During the past fortnight the market in Savannah, and in all the interior towns has been quiet, but very firmly held with limited offerings. The unsold portion of the crop is now estimated at about 2,000 bales, which is firmly held on a basis of Extra Choice to Fancy at 70c. As the trade has seemingly supplied its urgent requirements, there is at present apparently little demand. Such inquiry in the market has not recently resulted in any sales. Consequently the quotations represent the views of sellers.

We quote:—

GEORGIAS AND FLORIDAS.

Extra Choice & Fancy 70c = 72½c. landed, including war risk.

Choice & Extra Choice 69c. = 71½c. " " " "

Extra Fine & Choice 67c. = 69½c. " " " "

The exports from Savannah for the past fortnight were, to Northern Mills 630 bales, Southern Mills 62 bales, and from Jacksonville to Northern Mills 431 bales.

THE GROWING CROP has been retarded in its growth by unseasonably cool weather during the past fortnight. In some instances replanting has been necessary, and in a few instances some of the increased acreage has been replanted in corn. However, the increased acreage in Carolina is estimated at about 10 per cent., and in Georgia and Florida 20 per cent. The final out-turn is dependent on weather conditions from now on, which has become normal and promises to continue so. On account of the increased acreage the crop will exceed the last, and is now estimated at 135,000 bales to 140,000 bales.

Our next circular will be issued on June 2.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and fifty-eighth meeting of the Council of the British Cotton Growing Association was held at the Offices, 15, Cross Street, Manchester, on Tuesday the 3rd inst. In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.), Mr. J. Arthur Hutton occupied the Chair.

Reference was made to the loss which the Association have sustained through the death of Mr. William Marsland, who has been a valuable member of the Council for many

years, and it was decided that a letter be sent expressing the deepest sympathy with his widow and family.

DEPUTATION TO THE BOARD OF TRADE. It was reported that up to the present, no reply has been received to the representations made by the Deputation on February 8, beyond a letter to the effect that a Committee was in course of being appointed to enquire into the possibilities of developing cotton growing within the Empire. The opinion was expressed that some of the propositions submitted by the Deputation, especially the one relating to the construction of irrigation works in the Sudan, would not admit of any delay, and it was decided to convene a meeting of representatives of the various organizations who attended the Deputation, for Friday April 13 at 11.45 a.m., to consider what steps should be taken.

WEST AFRICA. On account of the damage caused by heavy storms of wind and rain early in February, the prospects for a big crop of cotton in Lagos are not so good as they were towards the end of 1916. At the same time the Association's Manager does not consider that the results will prove altogether disappointing, and he hopes that the purchases in Lagos this year will reach 10,000 bales or more. The unfavourable climatic conditions also appear to have affected the crop in Northern Nigeria, and the most recent reports state that the new crop is very late this season, and it is doubtful whether the crop in Northern Nigeria will amount to more than 10,000 bales. It is expected that the total crop in Nigeria will reach 20,000 bales this year, or about the same as for 1916, and in view of the present difficulties of transport it is doubtful whether it would have been possible to deal with a larger quantity.

The purchases of cotton to date in Nigeria amount to 6,316 bales, as compared with 11,003 bales for the same period of last year, and 1,860 bales for 1915.

UGANDA. It is expected that a considerable portion of this season's cotton crop will be shipped to India, as under present conditions the cost of bringing the cotton from Mombasa to Liverpool, due to heavy freights and war risks, works out at about 1d. per lb. more than the cost of sending it to Bombay. The statistics of cotton produced in the East African and Uganda Protectorates and countries to which the same was exported during the quarter ending September 30 last showed that 1,455,449 lb. of lint was exported to the United Kingdom, and 1,403,092 lb. to India and Burmah. It is anticipated that the figures for the quarter ending December 31, 1916, will show even a larger proportion of shipments to India.

SUDAN. The reports to the end of January were disappointing, but better accounts have recently been received, which indicate a considerable improvement on what had been anticipated from previous advices.

NYASALAND. The Director of Agriculture reports that there are heavy calls on the natives for portorage, but the cotton interests are not being neglected, in fact some improvement of cotton cultivation is possible, and a considerable improvement is hoped for in Fort Johnston, but as yet it is too early to give estimates. The Director of Agriculture states that everything practicable and possible is still being done in relation to cotton cultivation in Nyasaland, and although the conditions are difficult, especially transport, he has still a high opinion of the possibilities of the Protectorate.

WEST INDIES. It was decided that a cablegram be sent to Sir Francis Watts, the Commissioner of Agriculture for the West Indies, congratulating him on the honour recently conferred upon him.

GENERAL. Statement was submitted showing that 4,996 bales of cotton had been sold during the month.

COTTON GROWING IN THE BRITISH EMPIRE.

A notable paper was read by Mr. J. Arthur Hutton, Chairman of the Council of the British Cotton Growing Association last February, before the Manchester Athenæum on the question of the development of the cotton-growing resources of the Empire.

Mr. Hutton first proceeded to give some idea of the enormous value of the cotton trade in Great Britain by quoting figures showing that cotton goods form nearly one-third of the value of all the exports of manufactured goods from England. It is stated that the capital engaged in or directly dependent on the cotton trade of Lancashire is approximately £510,000,000. Curiously enough, the cotton trade is the only industry in Great Britain which depends almost entirely on the export trade. The value of the British home trade in cotton goods is estimated at only one fifth of the whole trade. In another sense the cotton industry is dependent on the import trade, in so far as it has to import all its raw material.

The danger of the situation lies in the fact that the cotton trade is not merely dependent on outside sources for supply, but largely dependent upon a foreign country. That country is the United States, which produces annually some 14,000,000 bales, of which several million go to Lancashire. It is therefore evident that America dominates the cotton world, and the price of middling American cotton is the best index of the relation between supply and demand.

But it is not the fact that Great Britain is dependent on the United States for cotton alone that matters; there is the fact that the United States produces long staple cotton—intermediate between Sea Island and short staple—for which the demand is greatest in the Lancashire mills.

A great deal has been said concerning the possibility of the supply of cotton in India, but this will not remedy the situation, Mr. Hutton points out, unless India produces long staple and not short staple cotton as she is doing at present.

One reason why it is so important to give immediate attention to the production of more cotton within the Empire is that the American home consumption is rapidly increasing. In 1913-14 the percentage of the American crop consumed in that country was 37·8, while in 1915-16 it rose to 53·0. It is therefore obvious that the enormous amount of capital invested in Lancashire is not secure in face of this encroachment of the American manufacturer. Mr. Hutton looks forward, unless something is done immediately, to short supplies for Great Britain, particularly as regards the finer cottons. The Lancashire trade is being gradually forced into the spinning and weaving of finer qualities which at present are beyond the capabilities of Lancashire competitors. It is therefore most imperative that this should be supplied, and the only way to do that is to increase production in the British Empire of fine staple cotton.

The finest cotton in the world is produced in the West Indies and in the American Sea Islands, but the production is a mere drop in the ocean compared with the production of long and short staple cotton. It seems to be clear that the Sudan must be looked to for an extension in the growing of ordinary long staple cotton. Mr. Hutton attaches very great importance to the Sudan as a cotton country, and refers to the Gezira Plain proposition as being the most practical and important yet put forward in connexion with the situation. The Gezira Plain contains over 5,000,000 acres of land, and when the irrigation works now in hand are completed, will produce more cotton than the whole of Egypt, which at present produces something like 1,500,000 bales. Mr. Hutton states definitely, that the Gezira scheme is the only proposition which

offers any prospect of producing an appreciable quantity of high-class cotton in the immediate future. This scheme, he states, is a certainty, whereas all other propositions for growing long staple cotton are to a certain extent problematical. It must not be forgotten that Lancashire is most in need of cotton of good quality.

Referring to Uganda, Mr. Hutton states that the industry in this Protectorate has made rapid progress, but since the war it has suffered a severe set-back. It may be noted that since the war Uganda has been selling long staple cotton to India, and the British Cotton Growing Association consider that an attempt should be made to furnish freight facilities, as far as possible, in order that this cotton may go to Lancashire instead.

In regard to Nyasaland, the present crop though small is of a type most useful to Lancashire. It is very nearly equal in quality to Uganda cotton, and is worth in normal times about 1d. to 2d. per lb over middling American. Mr. Hutton states that in Nyasaland, as in the Sudan, there has been no set-back in regard to cotton cultivation, in fact Uganda is the only country in which the industry has been seriously injured by the war. Reference is made at considerable length to cotton production in Nigeria and in India. Mr. Hutton gives a good deal of attention to the Indian question, and clearly indicates the nature of the Lancashire demand in his statement that, if he had to choose between an increased production of 500,000 bales of short staple cotton and 100,000 bales of long staple cotton, he would unhesitatingly take the latter. What Lancashire needs most in India is an increase in the production of long staple cotton, even if it meant a reduction of the area under short staple.

Looking into the future Mr. Hutton considers that the constructive activity of the British Cotton Growing Association in its present form and power and financial status has reached a culminating point; the magnitude of the Association's work is such that it now exceeds the capabilities of its promoters. Three possible alternatives are mentioned: (1) that a Government Department should be formed to take over the work of the Association; (2) that the Association should be reconstructed as a public trust with Government assistance and under Government control; (3) or that the work might be left for development to ordinary commercial enterprise.

All will agree that the last alternative must be ruled out. The consensus of opinion is likely to be that the best would be served by forming a Government department with colonial representatives in it to secure an increased production of long staple cotton. The very drastic reconstruction that is being carried out in regard to British agriculture, described in an article in the next issue, will no doubt cause public opinion and the Government itself to wake up to the seriousness of the situation, and take definite action to secure the existence of England's chief industry.

Relative Oil Yield of Florida Oranges.—

From a study of the commercial possibilities of the manufacture of orange oil from Florida cull oranges, a wide variation in the yield of oil of oranges under different climatic and cultural conditions was observed. The oil content has not reached its maximum until the oranges are fully mature, but the oil is present in commercial quantities before the fruit are ready for harvest. The occurrence of heavy rainfall during the season of harvest will cause a considerable decrease in the oil content. The presence of rust mite does not decrease the percentage yield of oil of the mature fruit, but may show some effect early in the season. (*The Experiment Station Record*, Vol. XXXVI, No. 3)

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

*Imperial Commissioner of
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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue discusses the practical value of electrical discharges, radium, humogen, and dynamite in regard to the stimulation of plant growth.

An interesting note on solid- and liquid-camphor trees appears on page 179.

On page 183 will be found an important article on the present position regarding the supply of cotton.

Insect Notes in this issue deal with weevils of the genus *Diaprepes*, and with West Indian soil grubs. Under Plant Diseases will be found two notes on the dissemination of angular leaf spot of cotton, and the source of the citrus canker infection in South Africa, respectively.

Dominica Exports, 1916.

We have been favoured by the Treasurer of Dominica with a statement of the imports and exports of the Presidency for the year 1916. The following items of export will be of interest to readers of this Journal:—

Bay leaves	£359	Citrate of lime	£9,244
Cacao	£17,151	Coco-nuts	£1,275
Fresh limes	£47,852	Lime juice, raw	£50,452
Lime juice, concentrated	£44,379	Vanilla	£48
Essential oils	£20,662		

There was also a considerable quantity of oranges and mangoes shipped, while the animal products, chiefly cattle and hides and skins exported, were worth something in the neighbourhood of £650. The total value of the imports into the island for the year was £208,197; the total value of the exports was £212,301.

Fruit-growing in the Nile Valley.

The Traders and Growers' Union of Cairo have owing to a recent extension in their nurseries published an enlarged issue of their catalogue in English, French, and Arabic, of fruit and ornamental trees for sale. It has been found necessary for the Union to do away with small retail sales and to devote their whole time and attention to the wholesale supply of large plantations. The catalogue contains useful hints as to packing and transport of plants and trees, and also on the time for planting trees, protection against wind, and spacing.

Fruit growing has received of late years a marked impetus in Egypt, and it may be asserted that orchards are destined to occupy an important area of the Nile Valley, and will within a short time claim second place after cotton in the resources of the country. Supporters of fruit cultivation contend that orchards yield a higher revenue than cotton.

It will be of interest to West Indian readers that the lime is grown extensively and, although its fruit is sold at a very low price, lime plantations in Egypt show substantial returns. Seedlings, and grafts on sour orange stocks are sold by the Union.

The banana is a plant which is likely to be largely cultivated in the Nile Valley, for no country offering, as Egypt does, a rich soil, a warm climate and an abundant supply of water, affords more favourable conditions for its cultivation. The two varieties grown are the Hindi and Sudani, and it is claimed that the former possesses a more exquisite flavour than either the Jamaica or the Canary banana.

Among other tropical fruits to be found in Egypt are the cherimoya, custard apple, grape-fruit, guava, mango, papaw, and prickly pear, so that in the course of time the tropics may meet in this country a formidable competitor in its fruit trade in the European markets.

Exports from British Honduras.

In the Annual Report for 1915 on British Honduras which has recently been published, it appears that the gross value of the trade of that Colony amounted to only \$4,384,851 in that year as against \$5,899,181 in

1914. The decrease is not entirely due to dislocation in trade on account of the war, but largely to the cessation of mahogany operations in Yucatan, and to the decline in chicle exports in Mexico. The value of the produce of the Colony shipped was only 58 per cent. of the exports, leaving the value of exports of foreign origin 42 per cent. The United Kingdom took 13 per cent. of the total export while 83 per cent. went to the United States. The chief articles exported were sapodilla gum, mahogany, coco-nuts, and bananas, the values being, respectively, \$1,231,655, \$479,064, \$145,317 and \$116,518. Shipments of bananas and plantains fell off considerably in 1915. The decrease in the export of mahogany, while attributable in some measure to the lack of tonnage, was chiefly due to dullness in the world's markets. Sales in England were only little more than half of those of a normal year and, as the stock carried over from 1914 was heavy, imports into England in 1915 were very limited.

Labour conditions at the beginning of the year were a source of considerable anxiety. In order to alleviate the situation and at the same time to assist one of the most important agricultural undertakings in the Colony, arrangements were made enabling the Government to advance \$60,000 to the Honduras Trading Company to be spent on the development of Crown lands at the back of Riversdale estate. The period of the loan is for five years, interest is at the rate of 5 per cent., and during the continuance of the loan the Company are to pay the Government a weekly sum equal to 3½ cents for every marketable bunch of bananas sold or otherwise disposed of during the preceding week.

West Indian Associated Chamber of Commerce.

The official report of the first triennial meeting of the Associated Chamber of Commerce of the British West Indies held in Trinidad in February and March last has been received. The inaugural meeting was held on February 26 when the proceedings were formally opened by the Governor of Trinidad. Delegates from the agricultural and commercial societies of Barbados, British Guiana, and of the Windward and Leeward Islands were in attendance. Among the chief resolutions passed was one urging the Home Government to institute a Customs Tariff such as would enable a substantial preference to be granted to goods produced within the Empire with a view to increasing the production and exchange, while the meeting also dealt with cable communication, mail service, harbour improvements, pilotage, consular services, certificates of origin, naturalization, the decimal system, and many other matters of commercial interest.

Prohibiting the Slaughter of Immature Cattle.

An Act has been passed in St. Lucia to prohibit the slaughtering of immature cattle and cattle in young. Every person, whether a licensed butcher or not, the Act reads, who slaughters any ox, steer or heifer which is not mature, unless it is a calf slaughtered for veal; or slaughters any animal which is known to be in calf, in lamb, in kid or in pig, shall be guilty of an offence punishable on summary conviction and shall be liable to a penalty

not exceeding £25. The defendant is liable to acquittal if he can prove to the satisfaction of the court that the animal was slaughtered in obedience to lawful authority, or from a humanitarian motive such as the prevention of suffering.

The object of the Act is, presumably, to secure the maximum production of meat and milk, and to increase the number of breeding animals. It is of interest in this connexion to note that the Committee of the Royal Society appointed in England early in the year to consider the food supply question of that country recommended that cattle *should* be slaughtered when immature, namely at seventeen months old instead of at two and a half years; such young beasts, it was pointed out, would be a little poorer in fat, but that would be counter-balanced by the enormous saving in feeding stuffs. Even in the West Indies where the food supply is not in such an acute state as in Great Britain, feeding stuffs like Indian corn, which are suitable for human consumption, should not be fed to live stock. There is no objection, however, to the utilization of cotton seed meal for this purpose.

Mr. Joseph Chamberlain and the West Indies.

In continuation of an article in the February number of *United Empire* on the late Mr. Joseph Chamberlain, Sir Daniel Morris, formerly Imperial Commissioner of Agriculture for the West Indies, writes in the April number of the above journal concerning the special interest Mr. Chamberlain took in the agricultural affairs of these islands. The responsibility of establishing the Imperial Department of Agriculture rested with Mr. Chamberlain, but his first *magnum opus*, as regards the West Indies, was the abolition of the foreign bounties on sugar, effected by the Brussels Convention of 1902. The banana industry of Jamaica, so far as its trade with the United Kingdom is concerned, owes a great deal if not everything to Mr. Chamberlain, for it was the contract which he made with Sir Alfred Jones that solved the problem of conveying across the Atlantic large shiploads of fresh tropical fruit and landing it in England in excellent condition. It is generally recognized in the West Indies that Mr. Chamberlain was one of the best friends these islands have ever had.

Science and Agriculture.

A recent issue of *Nature* (May 3, 1917) contains several articles of interest to those concerned with the advancement of tropical agriculture through the application of science. One of these articles deals with soil aeration in agriculture, and the conclusion is arrived at, that because of the very obviousness of soil aeration, agricultural science has scarcely given the subject the attention it deserves. Another note has for its title *The National Importance of Farm Vermin*. This is obvious, in view of the present shortage of food. In another article dealing with the British Science Guild, some interesting remarks made by the President of the Board of Education concerning the importance of science in education are embodied, while a letter contributed to the same issue deals with science teaching and national character.



INSECT NOTES.

SOME WEEVILS OF THE GENUS DIAPREPES IN THE WEST INDIES.

The weevils of the genus *Diaprepes* found in the West Indies are of great interest both from the systematic as well as the economic stand-point. For the last few years they have been studied by specialists both at the Imperial Bureau of Entomology in London, and at the Bureau of Entomology at Washington, and it has been considered that the different forms occurring in these islands would prove to be merely local varieties, which could be grouped under one or two species. From time to time collections of these weevils, which are the adults of the root borer grubs, have been submitted by Mr. H. A. Ballou, Entomologist on the staff of the Imperial Department, to Mr. W. D. Pierce of the Bureau of Entomology at Washington. These collections included not only the brightly coloured striped specimens known as *Diaprepes abbreviatus* and *D. spengleri*, but also the uniformly dark, greyish-brown weevils belonging to the genus *Exophthalmus*, and known in these islands as the Leeward Islands root borer.

Mr. Pierce recently sent back to the Imperial Department a representative collection of these weevils from most of the Lesser Antilles, to which he has added specimens of the varieties occurring in Santo Domingo and Porto Rico. For the sake of convenience these insects have been grouped as varieties of two species of *Diaprepes*, the *D. abbreviatus* and *D. spengleri* forms being placed under *Diaprepes abbreviatus*, while the *Exophthalmus* group is put under *Diaprepes famelicus*.

To the writer's knowledge Mr. Pierce has not yet published any detailed descriptions of these species and their varieties under this new arrangement, although a paper by him in the *Journal of Agricultural Research*, Vol. IV, No. 3, about two years ago, has reference to some of these varieties under a different grouping. The subsequent acquisition of more material of this group from these islands has enabled Mr. Pierce to rearrange the varieties to greater advantage, and further modifications may prove to be necessary after a still larger series of these weevils has been examined. It will be noticed that in each case a third scientific name is used to designate the particular variety. For instance, the full name of the variety of *Diaprepes abbreviatus* which occurs in Barbados is *Diaprepes abbreviatus distinguendus*, and that of the Antigua variety of *Diaprepes famelicus* is *Diaprepes famelicus esuriens*.

A table is appended giving the name and locality of each variety as determined by Mr. W. D. Pierce.

In addition to the varieties given below, there are in the collection of the Imperial Department specimens from Nevis and from Grenada, which have not been definitely named. The Grenada specimens come under *D. abbreviatus*, while the specimens from Nevis belong to the *D. famelicus* group. A form closely resembling the Antigua variety *esuriens* is known to be present in Barbados.

Locality.	Varieties of <i>Diaprepes abbreviatus</i> .	Varieties of <i>Diaprepes famelicus</i> .
Santo Domingo	<i>doublieri</i>	none recorded
Porto Rico	<i>doublieri</i> ; <i>spengleri</i> ; <i>abbreviatus</i>	" "
St. Croix	<i>rohrri</i> ; <i>farinosus</i>	" "
Virgin Islands	<i>doublieri</i>	" "
St. Kitts	none recorded	<i>lepidopterus</i>
Antigua	" "	<i>esuriens</i>
Montserrat	" "	<i>esuriens</i>
Guadeloupe	<i>distinguendus</i> ; <i>marginatus</i>	<i>famelicus</i>
Dominica	<i>quadrilineatus</i>	<i>lepidopterus</i>
Martinique	<i>quadrilineatus</i>	none recorded
St. Lucia	<i>quadrilineatus</i>	" "
St. Vincent	<i>quadrilineatus</i>	" "
Barbados	<i>distinguendus</i>	<i>barbadensis</i>

J.C.H.

SOIL GRUBS IN THE WEST INDIES.

This is the time of the year when many soil-inhabiting grubs, which are known as pests of some crops in these islands, are completing their life-cycle and emerging as adult beetles. These insects have been the subject of various articles in the *Agricultural News* and are fully dealt with in Pamphlet No. 73, issued in 1913 by the Imperial Department. Further details appeared in the *Agricultural News* for April 10, 1915 (Vol. XIV, No. 338). These pests are well known to the Agricultural Officers and to the planters in the different islands, but the importance of these insects both in the grub and adult stages, and the methods of control known at the present time cannot be emphasized too often. These insects are usually grouped under the two main headings, root borers and hard backs.

ROOT BORERS.

The insects generally known as root borers in these islands are now considered to be so closely related to each other that they can be grouped together as varieties of two species of the genus *Diaprepes*, viz., *D. abbreviatus* and *D. famelicus* (see the above table).

Root borers are attracting more and more attention each year as pests of such widely different crops as sugar-cane, Indian corn, limes, cotton, sweet potatoes, onions, ground nuts, etc., as is shown by the reports of the Agricultural Officers in the various islands during the past few years. The exact variety of root-borer grub responsible for the injury is not known in every case, but the nature of the injury appears to be similar where the same plants are attacked in the different islands. For instance, the injury done to mature sugar-cane in St. Kitts by the local variety of root borer has been found to be exactly similar to the injury done to the same plant by the variety of root borer in Barbados. The above table will show that the St. Kitts variety is closely related to the Barbados variety.

The feeding habits and life-history of the Barbados variety of *Diaprepes abbreviatus* have been worked out in considerable detail, and the knowledge that we have about the Barbados sugar-cane root borer will be of great assistance when dealing with the closely related forms in the other islands.

HABITS AND CONTROL METHODS.

At present the most satisfactory method of dealing with these root-borer pests seems to be the collection of the adult weevils and the egg-masses, and this would apply to all varieties. The adults are still emerging at the present time and can generally be found during the day at the base of the leaves of sugar-cane and corn, or among pigeon pea, sweet potatoes and other plants near the cane fields. In Grenada, Montserrat, Antigua, and the Virgin Islands the Diaprepes adults attack the young twigs of lime trees, often damaging these severely by notching the leaves. These adults often become very abundant, sometimes emerging together in thousands from a badly infested cane field and migrating to other vegetation.

In St. Kitts some 40,000 adults of the local variety were collected in a short time in a cotton field during April 1914. In Antigua during the early part of 1916 some 70,000 adults of the local variety were caught and destroyed on one estate where they were attacking limes. In Montserrat several thousands of the adults are collected every year on the lime tree experiment plot.

The eggs are laid on the leaves of many of the above plants and are usually hidden from view by a portion of leaf stuck down over them. Recent observations made by the Curator in Montserrat have established the fact that the local variety of weevil lays its eggs on the leaves of lime trees; the grubs attack the roots of the lime trees. Both the adults and the egg-masses can easily be collected by small boys.

Other measures of control are rotation of crops and the digging up of infested stumps after the canes are cut.

The hard backs will be dealt with in the next issue of the *Agricultural News*.

J.C.H.

THE MAKING OF PANAMA HATS.

The development of local industries other than or subservient to agriculture in these islands has never been of greater importance than at the present time. Nevertheless very little is being done to stimulate matters in this direction. Amongst those industries worthy of greater development are the fisheries, including shallow-water cultivations, pot and chair making, and the making of hats, particularly Panama hats. Professor Harrison in Demerara gave this matter attention a few years ago, and the following is an account by him of a visit to the hat-making school at Paramaribo, Surinam. The method of preparing the leaves of the *Carludovica* palm is described thus:—

The young and undeveloped leaves are cut with about 6 inches of the leaf-stalk attached: a sharp thin knife is then used for removing the larger veins of the leaf, and if this is done skilfully, the intermediary parts of the lamina alone are left attached to the upper portion of the stalk. The short stalk is then held in the hand and given a sharp switch, similar to the cracking of a whip, in order to see that all the intermediary parts are quite free from each other. After this, the leaves are put into boiling water and kept boiling for, say, ten to fifteen minutes. Care must be taken to see that the vessel in which the leaves are placed is not one of iron, as iron is said to stain them. After they are taken out of the boiling water they are put out in the sun for two or three hours to dry, and then bleached in a sulphur chamber for a day.

THE INDUSTRY RECOMMENDED FOR BRITISH GUIANA.

We were informed that it takes six leaves to make an ordinary sized hat, and that a coarse hat can be made in one day, while a finely made one would take about eighteen days. After the hats are made they may be hung in an air-tight box and subjected to sulphur fumes which will bleach them to a beautiful white. We were also shown straw from the *Æta* palm (*Mauritia flexuosa*) from which hats were going to be made. This palm, it may be stated, grows plentifully in swampy parts of this colony. We were especially interested in this school and formed the opinion that if a school, similar to it, can be started in this colony and made to pay, something will have been done towards solving the growing local problem of finding suitable employment for poor, respectable girls and young women. There should be no difficulty in cultivating *Carludovicas*, as they grow luxuriantly in the North West District of the colony, and even on fairly heavy clay land such as occurs at or near to the coast-land; and we are of opinion that they will also grow successfully in the Pomeroon, on lands in the Canals Polder on the West Bank, Demerara River, and on the light pegassy lands aback of our villages and plantations. The subject of a local hat-making school similar to the Paramaribo school on experimental trial is one which we venture to think is worthy of consideration.

FISH POISONING.

In the latest issue of the *West Indian Bulletin* (Vol. XVI, No. 2) there is an article on the subject of poisonous fishes in the West Indies, a subject which has been referred to before in the *Agricultural News*.

An attempt is made in the article in the Bulletin to bring together such information as is available, including that contained in Pellegrin's thesis (Paris 1899), Evermann and Marsh's Report on Porto Rico fishes, Tate Regan's Report on West Indian poisonous fish, and other important papers and works dealing with the subject.

It is pointed out first that poisoning from fish may occur in several different ways:—

(1) Poisoning by ingestion, that is, by the consumption of fish as human food. This may happen from two different causes:—

(a) The occurrence of a toxin in the body of the living fish;

(b) the production of toxins in the flesh of the fish after death, due to decomposition.

(2) Poisoning by inoculation of venom through wounds inflicted by the fish.

Coming under the heading of (a) are the Barracoutas, certain sprats, the parrot fishes, the horse-eye Jack, the drunken or plate fish, and the globe and porcupine fishes. The degree to which, and the conditions under which, these fishes are poisonous vary.

Under (b) most fish come that are consumed as food, but the Cravallés appear to be specially dangerous in this respect.

The second chief group, which is poisonous by means of venomous wounds, is represented by the scorpion or Lion fish, the morays or tropical eels, and the batrachus. There are other forms of marine life, not belonging to the true fishes, which may also be included—for example, the sea-egg and the 'Portuguese man o'war'.

The article gives an account of the symptoms of poisoning from these causes, and of the treatment that has been successfully adopted.



GLEANINGS

In the last issue of the *Agricultural News* a mistake was made in stating that observations showing the number of days on which rain falls is only a newly introduced feature into the St. Lucia meteorological records. St. Lucia happens to be one of a very few islands where this observation has been systematically carried on for many years past.

Tropical Life for April 1917 contains a biographical statement of the career and present work of Mr. F. W. South, Chief Agricultural Inspector, Department of Agriculture, F.M.S., formerly Mycologist on the staff of the Imperial Department of Agriculture for the West Indies. Mr. South is principally occupied in the F.M.S. in enforcing the Plant Pests Enactment.

During the German South Africa campaign glanders broke out among the horses and other transport animals of the Union forces, and stringent measures had to be taken to combat the disease; but in spite of everything the mortality was approximately 6,000 animals. The veterinary surgeons were, however, by prompt action, able to save the situation and the lives of more than 40,000 horses.

The University of California *Publications in Botany* (Vol. V, No. 11, pp. 301-46) contains an interesting paper illustrated by admirable plates on the nature of the first generation cross between different species of *Nicotiana*. It has been found that crosses between *N. sylvestris* and varieties of *N. Tobaccum* always display the characters of the particular *Tobaccum* variety used in the cross, but usually on a greatly enlarged scale.

A Treasury grant of £125,000 by way of loan has been made towards the purchase of an estate of 5,600 acres at Kelham, near Newark, England, where it is proposed to grow sugar beet and to erect a factory for its manufacture into sugar. The enterprise, which is estimated to cost £500,000, is referred to in the interim report of a Parliamentary Committee appointed to report on the matter, as being thought out with great care and as a sound one.

The results obtained with varieties of sugar-cane in Assam are set out in the Annual Report on Experiments and Demonstration for 1916. The yield given of cane sugar in juice in pounds per acre for B.376 ranged from 5,945 to 4,417 lb. B.147 gave a low yield on the average, while the Indian canes gave very much less. The Indian canes contained about 12 to 14 per cent. sugar in juice compared with 16 to 18 in the case of the Barbados and Mauritius varieties.

In the East Africa Protectorate coco-nut planting, says the *Bulletin of the Imperial Institute* (Vol. XIV, No. 4), is the chief industry on the coast-lands and is likely to remain so. Native plantations, it is stated, are in a very unsatisfactory state owing to tapping of the palm, and to the attacks of *Oryctes* beetles and fires. The copra produced appears to be of a somewhat inferior quality that could easily be improved with a little more care and attention.

According to the Colonial Report on Nyasaland for 1915-16, the export of tea for the year was valued at £8,585 or an increase of £4,429, while the acreage increased from 3,303 to 4,141 acres. Taking into consideration the greatly increased local consumption, it will be seen that the output was practically doubled. The bulk of the crop was sold on the London market at from 8d. to 1s. per lb., a satisfactory price when the low cost of production is taken into consideration.

Information has been received from the Secretary of the British Cotton Growing Association stating that the death has occurred on April 3, of Mr. William Marsland. Mr. Marsland was one of the delegates to the West Indian Agricultural Conference in 1912. We take this opportunity of expressing regret at the untimely loss of a useful member of the Council of the British Cotton Growing Association, and one who took a particular interest in matters relating to the development of the West Indian cotton industry.

In the *Agricultural Gazette of New South Wales* for March 1917, the following dairy wash, which has the advantage that the materials are readily at hand, is recommended:—

'Mix air-slaked lime in the freshly skimmed milk to a suitable consistency, so that it can be applied smoothly with the brush. To each gallon of the mixture add one ounce of table-salt. It is advisable to make just sufficient wash for the day and to use it fresh. This wash dries readily on wooden or iron surfaces. It possesses the advantage of adhering firmly, does not flake off, and lasts longer than most of the washes now in use.'

In the *Agricultural Journal of India* for January 1917, the following interesting particulars are given as to the selection of the best colour for wall papers and hangings. Wall papers were tested for their light-absorbing qualities, with the following results: white, percentage of light absorbed, 30; chrome yellow, 38; orange, 50; plain deal, 55; yellow, 60; light pink, 64; emerald green, 82; dark brown, 87; vermilion, 88; blue-green, 88; cobalt-blue, 88; dark chocolate, 96. The above shows that, if a room papered with dark-green be repapered with chrome yellow, it will be four times as light with the same lamps. In many cases house-holders pay too much for electricity and gas lighting because their light-absorbing wall coverings destroy the light rays.

SOIL AERATION AND THE GROWTH OF SAL SEEDLINGS.

A series of papers is being published in the *Indian Forest Records* on the œcology of Sal (*Shorea robusta*). Part III deals with soil aeration and water culture. In summarizing the results of the investigation, Mr. R. S. Hole, F.C.H., F.L.S., says:—

The present experiments have confirmed the results previously obtained regarding the very injurious effect of bad aeration on the growth of Sal seedlings in the local forest soil.

When water is long held in contact with this soil, which is the case under conditions of bad aeration, it becomes heavily charged with carbon dioxide and impoverished as regards its supply of oxygen.

The bad growth of Sal seedlings in this soil is correlated with an accumulation of carbon dioxide in the soil solution and a low oxygen content, and this possibly explains the evil effects of bad aeration. Further work, however, is required to prove this and also to decide the relative importance of carbon dioxide and oxygen, respectively.

Liming this soil, immediately before sowing, has an injurious effect on Sal seedlings, and during the rains, soil which has been thus limed appears to contain more carbon dioxide and less oxygen than the untreated soil. It seems possible that this may be due to accelerated bacterial activity. This point, however, requires further investigation.

As carbon dioxide is rapidly dissipated and a deficiency of oxygen made good under the ordinary conditions of water-cultures, it is not easy to prove the effect of varying quantities of these gases on plants grown in such cultures. For the same reason, artificial aeration of such cultures may not show any beneficial result.

As Sal seedlings can be successfully grown in water-cultures, the injurious effect of bad aeration is not due to water as such. This probably explains the fact that Sal can grow in practically saturated soil on the banks of rivers or even of stagnant lakes, in which the water is kept well aerated by exposure to the air or the presence of green aquatic plants.

Suggestion of Anti-Mosquito Measures in Antigua.—The prevention of malarial and filarial diseases in Antigua and the Leeward Islands generally has not received much attention hitherto. In order to induce the co-operation of employers of labour throughout the island in a comprehensive scheme of mosquito destruction, the author of a recent paper [Dr. W. M. McDonald] proposes the establishment of an experimental area in which various anti-mosquito measures may be tried, a record being kept of their relative cost and efficiency, and of the return of malaria in this area. The utilization of natural enemies is a measure which has to be applied with a due regard to the many methods by which mosquitoes may escape attack. It was observed in this connexion that while small fish occurred in great numbers in the open water of certain ponds, mosquito larvae were also very numerous among the grass and vegetation round their edges. The latter must therefore be kept clear if the fish are to be of use. Oiling is likely to prove the most practical method of dealing with the majority of breeding places in the island, while draining is also to be tried. (From the *Review of Applied Entomology*, Series B, Medical and Veterinary, February 1917.)

EXPERIMENT STATION IN THE ARGENTINE.

The new members of the staff of the Experiment Station in the Tucuman Province in the Argentine have already taken up their duties, and the Experiment Station which is now well organized, both for research and technical consulting work, is rapidly approaching the maximum of usefulness and value for the Province.

The principal function of the Station is that of investigating the most important agricultural and industrial problems; to discover the best varieties of plants already cultivated, and introduce new crops; to try to increase the production per acre, and improve as well as cheapen the methods of cultivation; to help by means of the investigation of problems and difficulties, the industries of the Province; to discover new industries by means of scientific experimentation, and encourage them; and to study the insect and fungus pests of the Province with a view to exterminating or controlling them.

The reports giving an account of the investigations carried out by the different departments will be published, as is usual, in the *Revista Industrial y Agrícola de Tucuman*, the official organ of the Station, and in order that the Province may be able to take as much advantage as possible of the results of the experiments and investigations, the practical conclusions of the work in each case will be published in the form of circulars, which will be distributed amongst all interested.

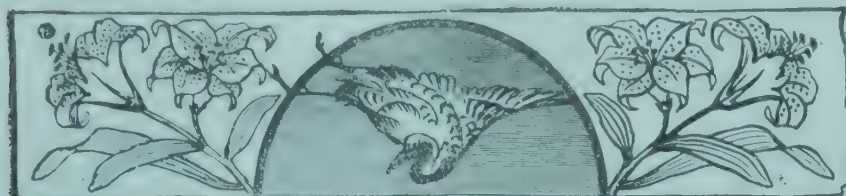
The second important function of the Station is that of giving advice and help to agriculturists and others in their struggle against the difficulties and problems which they encounter in their work. Naturally, the Station cannot promise to solve all the problems presented for study, but, in a large percentage of the difficulties which are met with in the agricultural and industrial life of the Province, the advice and technical help of the Station will undoubtedly be of much service.

It is hoped, therefore, that the agriculturists and manufacturers of the Province will co-operate with the Experiment Station in studying carefully their problems, and that they will follow the recommendations and advice given as a result of the investigations.

Finally, in order to give more publicity to the reports of the Station, it has been resolved to distribute the *Revista* gratuitously all over the Province. It is hoped by this means to increase the usefulness both of the magazine and of the Station itself in the Province of Tucuman.

Forests of Porto Rico.—A recent Bulletin comprises a report of a survey of forest problems in Porto Rico, conducted by the Forest Service in co-operation with the Government of Porto Rico. It also revises and brings up to date two previous Bulletins of the Forest Service dealing with the forests and forest conditions of Porto Rico. A general account is given of the physical and economic features of Porto Rico, together with a discussion of the condition and distribution of forests, forest formations, forest influences, commercial aspects, forest industries, products and problems, and suggestions relative to an insular forest policy.

Appended to the Bulletin is a descriptive account of Trees of Porto Rico, by W. D. Brush, L. S. Murphy, and C. D. Mell. Each species is described with reference to its nomenclature, distinguishing characteristics, wood structure, and economic uses. A bibliography of consulted literature is also appended. (*Experiment Station Record*, Vol. XXXVI, No. 3.)



PLANT DISEASES.

DISSEMINATION OF ANGULAR LEAF SPOT OF COTTON.

The *Journal of Agricultural Research*, Vol. VIII, pp. 457-75 contains a detailed account by Mr. R. C. Faulwetter, South Carolina Experiment Station, of studies in the methods of distribution of the bacterium producing angular leaf spot.

Artificial infections are easily secured by spreading bacterial suspensions on the upper or under sides of the leaves, the familiar water-soaked spots appearing usually in seven to ten days.

The source of the first infections of the season is not yet determined. Large numbers of seedlings raised indoors during the winter showed no sign of the disease. In the late spring two instances of cotyledonary infection occurred in the greenhouse. An acre field planted in April remained free of natural infections until August. Another field planted in May developed considerable disease in the seedlings. Another experiment gave forty-five diseased plants out of 36,568 at the end of twenty days. From the lot of seed which gave most infections (0.46 per cent.) 1,218 seedlings raised in the greenhouse in August showed no instance of the disease.

In the plots under observation no definite evidence of any dissemination of the disease by insects was noted.

The most important positive information obtained in the investigations came from observations made in a field in which a long row of plants was artificially infected. The ensuing spread of the disease was charted, and the results point to the conclusion that the predominant factor in the distribution of the disease is wind-blown rain. This accords with the known ability of the bacterium to produce infection on healthy leaves provided a film of water is present. A continuation of the studies is proposed in which closer attention will be given to the meteorological factors favouring the spread of the disease.

SOURCE OF THE CITRUS CANCER INFECTION IN SOUTH AFRICA.

In the issue of this *Journal* dated March 10, 1917, appeared a review of *Science Bulletin* No. 8, of the S. A. Union Department of Agriculture, on citrus canker in South Africa.

The occurrence of the disease in South Africa was attributed, on the strength of definite statements in that bulletin, to an importation of grape-fruit trees from Florida in 1905-6.

A letter has now been received from Mr. Wilmon Newell, Commissioner of the State Plant Board of Florida, enclosing copies of communications on this subject, received from the Union Secretary for Agriculture, the Chief of the Division of Horticulture, and the Government Horticulturist.

From the information thus supplied it appears that although the affection was first noticed on the Florida trees, which proved very susceptible, it is equally possible that the disease originated from Japanese stocks imported about the same time. These have proved highly resistant, but are not necessarily immune—a condition which favours introductions by reason of the restricted lesions escaping notice. That Japan and not Florida was the source of infection appears to be certain from the following statement made by Mr. Newell:—

'The first introduction of citrus canker into Florida has been very definitely and conclusively established as being in November of 1912, and from our knowledge of the conditions existing in Florida with reference to this disease, it is impossible, in the opinion of all authorities conversant with the situation here, that the disease should have been introduced into South Africa from Florida at so early a date as 1906.'

This assignment of a definite date to the beginning of the Florida infection may set at rest in most cases the apprehensions that have been felt with regard to the effect of past introductions of nursery stock from Florida into the West Indies.

W.N.

TRIAL OF AGRICULTURAL TRACTORS.

A large amount of attention is being given at present in England to the employment of tractors for ploughing and other agricultural purposes. In a recent issue of *The Field* (March 5, 1917) reports appear of several official trials and demonstrations which seem to have been very satisfactory. Reference is made to the 'Dugout' Daimler tractor and to the Bates Steel Mule tractor, both of which are illustrated at work. The latter gave excellent results on old pasture land near Lewes recently, while a trial with a Ford tractor is described as follows:—

'The Royal Agricultural Society, at the request of the Board of Agriculture tested two agricultural tractors last week in Cheshire. These tractors were manufactured by Mr. Ford, of America, who has placed at the disposal of the Government all plans and specifications of his machine, as well as the services of his experts. The tractors, it is understood, may be made by British firms provided they are not sold but used by the Government.

'The following report has been submitted by the Judges:

'At the request of the Royal Agricultural Society of England we have examined two Ford tractors rated at 25 h.p. at working ploughing.

'First, cross-ploughing a fallow of strong land in a dirty condition and subsequently in a field of lighter land which had seeded itself down into rough grass and which afforded every opportunity of testing the motor on the level and on a steep hill.

'In the first trial a two-breast Oliver plough was used, ploughing on an average 5 inches deep with 16 inches width of furrow, subsequently with a three-furrow Cockshutt plough at the same depth with breast pitched 10 inches.

'In the second trial the three-furrow plough was used, ploughing an average of 6 inches deep.

'In both cases the motor did its work with ease, and on a measured acre the time occupied was one hour thirty minutes, with a consumption of 2 gallons of paraffin per acre.

'These results we consider very satisfactory.

'The ploughs were not quite suitable to the land, and the tractors consequently were working at some disadvantage.

"The total weight of the tractor fully loaded with fuel and water, as weighed by us, was $23\frac{1}{4}$ cwt.

"The tractor is light for its power and consequently light on the land, is easily handled, turns in a small circle, and leaves a very narrow headland.

"The motor is quickly started up from cold on a small supply of petrol.

"After these trials we proceeded to Messrs. Ford's works at Trafford Park, Manchester, where one of the motors had been sent to be dismantled and inspected in detail.

"We find the design of ample strength, and the work of first rate quality. We consider the driving wheels rather light, and we understand that a new and stronger pattern is to be supplied in future.

"The tractor is designed purely for working on the land, and the wheels, which are fitted with spuds, should be provided with some protection to enable them to travel on the road when moving from farm to farm.

"Bearing the above points in mind, we recommend, under existing circumstances, that steps be taken to construct immediately as many of these tractors as possible."

It may be added that a great deal is being done by the Ministry of Munitions on some of their lands, to popularize motor traction, and a note on this subject appeared in the last issue of the *Agricultural News*. The co-operative use of a motor plough in England is described in the *Journal of the Board of Agriculture* of England and Wales for June 1916, while the same Journal for October 1916 deals with the trial of tractors for a variety of agricultural purposes, and the issue for January 1917 with trials made in France. There is no doubt that very soon the motor tractor will be a common object on the English farm.

An Experiment in Long-continued Inbreeding.—More than 25,000 guinea-pigs have been reared by the Bureau of Animal Industry on its experimental farm at Beltsville, Md., to test the effects of inbreeding. Brother and sister have been mated in each generation, and some of the families have now reached the seventeenth generation. While a few strains have run out, others are nearly as vigorous as are the control families. But the important fact is that there is no general deterioration; the various defects that have appeared are not correlated. One family becomes strong in one respect and weak in another; in a second family conditions are exactly the reverse. Such a state of affairs does not lend any support to the popular idea that inbreeding necessarily produces degeneracy. The various kinds of deterioration are to be accounted for in different ways. In general, the belief of geneticists is apparently confirmed, that even long-continued inbreeding does not necessarily mean deterioration. It tends to make the members of a family more alike, and to perpetuate all variations that occur. If the strain is a good one, inbreeding will improve it; if it is a weak or defective one, inbreeding will bring the defects into prominence and probably lead to the elimination of the strain. When the results of this investigation (which is in charge of Dr. Sewan Wright) are finally published, they should furnish more precise and detailed information about the effects of inbreeding than has heretofore been available. (From the *Journal of Heredity*.)

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market, for the month of April 1917:—

There is little or no change to be reported in the general condition of the drug and spice markets since our last report for March. All the same drawbacks exist to prevent increased demands at increased prices, with the result that purchases are made in decreasing bulk sufficient only for present demands. The entry of America into the war has also had much to do in unsettling the markets for the moment, in view of the possibility of supplies of war necessities being drawn to America. The following are some of the principal items.

GINGER.

This article has been in but little demand throughout the month. At the last auction on the 25th small purchases were said to have been made of Sierra Leone at 45s. per cwt. in Liverpool. In Mincing Lane some 200 bags of rough brown Calicut were offered, and bought in at 70s. to 75s. per cwt., and out of 110 bags of fair limed Japanese offered, 80 were sold at 49s. per cwt.

SARSAPARILLA.

At the first drug auction in the month, namely on the 4th, the offerings of this drug were limited to 25 bales of Mexican and 4 of native Jamaica, neither of which found any buyers. Later on in the month it was said that there were enquiries for both grey Jamaica and Lima, both of which were expected to arrive shortly; meantime some sales of native red Jamaica had been made at 1s. 6d., and Mexican at 1s. 5d. to 1s. 6d.

CITRIC ACID, ANNATTO, CASHEW NUTS, CANELLA ALBA, KOLA, LIME JUICE, PIMENTO, TAMARINDS, AND ARROWROOT.

At the beginning of the month citric acid was firm at from 3s. 4d. to 3s. 5d. per lb., maintaining the latter price for the rest of the month.

Annatto seed was in good supply, fair bright being quoted at 8d. At the first auction on the 4th of the month as many as 57 packages of cashew nuts were offered, none of which, however, found a buyer. Ten packages of Canella alba bark also were offered at this auction and none sold, while 90 packages of kola, also brought forward at the same sale, were all disposed of, 13 packages of West Indian fetching $5\frac{1}{4}$ d. to $5\frac{3}{4}$ d. per lb. for medium to bold: whole nuts and halves, African, which were reported as very scarce, were disposed of at the following rates: good sound quarters $8\frac{1}{4}$ d. and $7\frac{3}{4}$ d. for slightly wormy. Lime juice was represented at the same auction by 36 puncheons, only 9 of which found buyers at the following rates: fair pale raw Grenada 1s. 9d. per gallon, and brown Trinidad 1s. 6d.

The quotation for pimento in the early part of the month was from $4\frac{3}{8}$ d. to $4\frac{1}{4}$ d. per lb., and at the end of the month 150 bags were offered and bought in at $4\frac{1}{4}$ d. A consignment of tamarinds was brought forward at auction on the 12th of the month: the price asked was 40s. per cwt. for new Barbados, duty paid. Quite at the end of the month a consignment of some 46 barrels of good manufacturing St. Vincent arrowroot was offered and bought in at $5\frac{1}{4}$ d. to $5\frac{1}{2}$ d.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
April 19, 1917.

ARROWROOT—4½d. to 6½d.
BALATA—Block, 3/3½ to 3/5; Sheet, 3/8 to 3/11½.
BEESWAX—No quotations.
CACAO—Trinidad, 82/- to 85/-; Grenada, 65/- to 81/-; Jamaica, no quotations.
COFFEE—Jamaica, 62/- to 63/-.
COPRA—£43 10s.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £21 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
ISINGLASS—No quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—1/3 to 2/-.
NUTMEGS—1/1½ to 1/6.
PIMENTO—4½d.
RUBBER—Para, fine hard, 3/1½; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, 4/9 to 5/3.

New York.—Messrs. GILLESPIE BROS. & Co., April 11, 1917.

CACAO—Caracas, 12½c. to 12¾c.; Grenada, 12c. to 12¼c.; Trinidad, 11¾c. to 12c.; Jamaica, 10½c. to 11¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$42.00 to \$44.00; culls, \$28.00 to \$30.00.
COFFEE—Jamaica, 9½c. to 11½c. per lb.
GINGER—16½c. to 20c. per lb.
GOAT SKINS—Jamaica, \$1.20; Antigua and Barbados, \$1.10 to \$1.15; St. Thomas and St. Kitts, \$1.00 to \$1.10 per lb.
GRAPE FRUIT—Jamaica, \$1.25 to \$1.75.
LIMES—\$5.00 to \$6.50.
MACE—37c. to 42c. per lb.
NUTMEGS—21c. to 22c.
ORANGES—87½c. to \$1.50.
PIMENTO—5¾c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 6.27c; Muscovados, 89°, 5.75c.; Molasses, 89°, 5.25c all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., May 18, 1917.

CACAO—Venezuelan, \$12.00 to \$12.50; Trinidad, \$11.50 to \$12.00.
COCO-NUT OIL—\$1.27 per Imperial gallon.
COFFEE—Venezuelan, 10c. to 11c.
COPRA—No quotations.
DHAL—No quotations.
ONIONS—\$1.00 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$8.00 per 100 lb.
RICE—Yellow, \$10.00 to \$10.50; White, \$6.50 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., May 16, 1917

ARROWROOT—\$6.00 per 100 lb.
CACAO—\$13.00 per 100 lb.
COCO-NUTS—\$26.40 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$8.50 to \$9.00.
PEAS, SPLIT—\$10.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$9.50; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$4.75 to \$5.00.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND- BACH, PARKER. & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



A FORTNIGHTLY REVIEW

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Local Production of Foodstuffs.

IN an article in the *Agricultural News* of January 13 last, attention was drawn to the fact that, owing to the high prices being obtained for West Indian staple products, and to the absence of superabundance of labour to produce them, there was a tendency to shirk the question of producing food crops. There remained, it was pointed out, an

undue dependence upon imported foods which might entail unpleasant consequences in the near future. As the question was a general economic one bearing on that of the labourers on whom the successful working of the estates depends, and on the welfare of the community, it was necessary, in order to stimulate progress in this direction, to create sound opinion and to make vigorous efforts in this matter.

Since January events have moved with rapid strides, and there is ample justification for reverting to what is one of the most urgent problems of the day. Even if the submarine menace has not had the paralyzing effects upon importations into the Mother Country which were anticipated by the enemy, it has, nevertheless brought England into measurable distance of compulsory food restrictions. The entrance of the United States into the war will mean, at any rate for the present, greater difficulties in the West Indies obtaining adequate supplies of imported food, not only on account of the requisition of merchant vessels for war purposes, but also of the greater demand for wheat in other countries. Despite a prospect of more than an ordinary yield of spring wheat, the wheat crop of North America for 1917 will, as forecasted by the United States Department of Agriculture, fall far below normal: although the yield, estimated at six hundred and fifty-six million of bushels, will give sixteen million more bushels than last crop, it will not, with the heavy demands from abroad and with practically no reserve store, meet war needs, unless the most rigid economy is practised.

In England the result of recent experience has been a rapid change wrought in the popular attitude towards land problems. Before the war, most persons were possessed with the comforting thought that

cheap and ample supplies of food would always flow from abroad, for few foresaw that developments of naval warfare would interrupt that flow, and would create a condition of positive scarcity and consequently high prices such as at present exist. By bitter privations everyone is being brought to recognize that extreme dependence on imported supplies is a source of national weakness, and that the greater the necessity for buying in outside markets the less control can be exercised over prices.

An account of the measures of agricultural reconstruction that have recently been introduced in Great Britain will be found on another page of this issue.

Naturally the conditions of food supplies which are engrossing the attention of the Home Government as the most serious problem of the hour will react upon the supply of foodstuffs into the West Indies. There are clear indications that in some of the islands, faced at present with the period of the year when scarcity of local provisions is coincident with the earning of small wages and the minimum purchasing power of the labourer, the necessity for increasing the local production of foodstuffs has not been recognized a moment too soon. Antigua and St. Vincent are wise in having erected corn driers; arrangements have been made for placing these appliances at the service of the growers or for purchasing, drying and storing the grain on co-operative lines. In St. Vincent, corn dried and stored since August of last year was in March still in good condition and was converted into meal for local consumption. Had the whole of the grain dried in St. Vincent been stored for future use, it is estimated that there would have been sufficient to meet the demands of three months food supply. In islands dependent more or less on sweet potatoes and other ground provisions which cannot be stored, the situation in the West Indies has, of late, been aggravated by the absence of rain necessary for planting, so that the reaping of sweet potatoes will naturally be abnormally late this year, too late in fact for the critical months when dependence has to be placed mainly on imported foodstuffs.

To maintain a sufficient supply of food in British Guiana the Government has prohibited the exportation of rice, and several West Indian islands have forbidden ground and other provisions, deemed necessary for local requirements, being shipped. In Barbados an Act to make provision for increasing the production of vegetable foodstuffs during the current year has been passed. The Act, which is interesting, being the first legislative attempt to meet the situation in the

West Indies, defines ground provisions, provides the machinery for carrying out the purposes of the Act by the appointment of seven commissioners, and makes it the duty of every owner of three or more acres of arable land to plant and cultivate ground provisions at such times and in such manner as may be required by the Commissioners, provided the area thus planted does not exceed 10 per cent. of the arable land of the owner. It is also recognized that, if its provisions are to be effective, prædial larceny must be checked as far as possible, and power is given to Magistrates, during the years 1917 and 1918, to order the flogging of those convicted of stealing or abetting the theft of ground provisions.

Even after the war the question of a satisfactory supply of local foodstuffs, especially of those suited for storage, will have to be carefully considered in all the West Indian islands. In a paper on food supplies contained in Volume I (1900) of the *West Indian Bulletin*, the present Imperial Commissioner gave a note of sound advice and warning in the following words: 'This opens up a wide field of work for various officers of the Agricultural Departments, who may be charged with such duties as drawing attention to crops calculated to improve the dietaries, the inculcation of sound ideas in conjunction with the food consumed, and of watching generally the economic bearings in relation to the food supply. These questions are of great importance, for, on a proper solution of them the prosperity of many of the islands may depend, particularly those where the struggle for existence is most keenly felt. A proper use of food supplies must constitute an important factor in the cost of production of the staple commodities, and determine the ultimate success or failure of a country.'

LOCAL FOOD SUPPLIES IN ST. VINCENT.

In the above article the question of the local production of food supplies in the West Indies has been dealt with in a general way. In the present article will be recorded certain information supplied by Mr. W. N. Sands, Agricultural Superintendent, St. Vincent, concerning efforts made in regard to the planting and preservation of local food supplies by the Department in that island. Mr. Sands prefaces his report by expressing the belief that this season far greater care will be taken to conserve home-grown foodstuffs. The warnings issued last year were in many cases unheeded, and as a result the supply of corn, in particular, is short of local requirements. Recently the Government has prohibited the export of corn and corn products, peas, beans and farine, but the quantities left from last crop are small, and the new crops will not come in until September. At the Ginnery, supplies of corn and peas that remain are being stored for planters free of cost.

Turning to the detailed report, Mr. Sands states that anticipating high prices, if not reduced supplies this year, of imported foodstuffs, he made arrangements at the Government Cotton Ginney in August 1916 to store all the Indian corn (maize) taken over from growers on a profit-sharing basis. By sealing a storeroom, and by the erection of a number of bins, accommodation for 700 cwt. of kiln-dried corn was provided. The purchases of maize amounted to about 620 cwt. The payments made on account to growers were at the rate of 84c. per 100 lb. for corn on the cob and 1c. per lb. for shelled corn. Towards the end of last March, owing to the high prices of breadstuffs and rice, Mr. Sands started to convert the corn which, by the way, had remained in perfect condition, into meal, using the power-grinding mill at the Ginney. To date about 550 cwt. of the corn has been sold as meal for human consumption at the rate of \$3.75 per 100 lb., and 4c. per lb. for smaller lots, and the demand far exceeds the supply available. Besides this, several corn growers have had considerable quantities of corn dried and converted into meal at the Ginney for local use. Unless there had been a kiln-drier available, Mr. Sands points out, the preservation of the corn purchased could not have been successfully performed as the corn would have been attacked by moulds. The attacks of grain insects were easily prevented by the use of carbon bisulphide.

It appears that if large growers generally had made provision for the storage of corn on their estates instead of shipping it, and a large number of small growers had taken advantage of the facilities offered for the purchase, drying and storage of corn at the Ginney, there would have been quite enough locally grown corn to supply the demand of the next three months at a reasonable price.

In view of the prospects of restricted supplies of imported foodstuffs as well as high prices for such as were available, Mr. Sands held a series of meetings in April, which were attended by small owners and renters of land. In all, Mr. Sands addressed people at eleven different centres. In his addresses he spoke, amongst other things, of the necessity of planting and preserving at home certain food crops, particularly with the idea of carrying over the critical months of March to September next year. Mr. Sands called attention to another point of importance. There is reason to believe that a considerable quantity of corn meal suitable for human consumption is fed to horses and poultry. It is believed that meal for this purpose has been purchased from the Government Ginney. As Mr. Sands points out, inferior grades of corn and of other foodstuffs may be used for feeding to live stock, but it is very undesirable, in view of the large amount of land available for pasturing and the adequate supply of cotton-seed meal and other feeding stuffs, that a high-grade Indian corn should be fed to animals. Mr. Sands suggests that legislative action should be taken to prevent this wasteful practice.

FOOD SUPPLY LEGISLATION IN BARBADOS.

On May 16 last, an Act to which reference is made in the editorial of this issue was passed in Barbados to make provision for increasing the production of vegetable foodstuffs in the island for the current year. Ground provisions are defined as including sweet potatoes, yams, eddoes, corn, cassava, peas, beans, and all plants producing crops which provide foodstuffs for human consumption. It is made the duty of every owner or person having chief charge and control over the cultivation of any arable land of 3 or more acres to plant and cultivate it at the time and in the

manner required by the Commissioners, provided that the area required to be planted does not exceed 10 per cent. of the arable land of any owner. To carry out the provisions of the Act, seven Commissioners are to be appointed by the Governor-in-Executive Committee, to whom within twenty-one days from the passing of the Act returns of the arable acreage, together with the acreage in first crop canes and that in ratoons, are to be forwarded. On the receipt of the returns the Commissioners will send every owner a notice specifying the number of acres in which he is required to plant ground provisions; the kinds of ground provisions and the number of acres of each kind he is required to plant; and the time or times at which, as soon as weather conditions render planting feasible, he is required to plant. Every owner must comply with the requirements of the notice and keep the land so planted in good condition, or be liable to a fine of £10 for every day for which he fails to comply with the provisions of the Act. To ascertain if the requirements of the Act are being carried out, inspectors appointed by the Commissioners will visit the plots planted in ground provisions from time to time, and will have the power to enter at any time between 6 a.m. and 6 p.m. on lands subject to the operation of the Act.

Under section 10, any person being a male found guilty, during the years 1917 and 1918, of stealing, or of abetting the theft of, ground provisions, may be sentenced to be flogged in addition to undergoing any other punishment which may be awarded.

Madagascar Beans in St. Lucia.—The Agricultural Superintendent, St. Lucia (Mr. A. J. Brooks) has informed the Imperial Department of Agriculture that in recent trials, a variety of the Madagascar bean (*Phaseolus lunatus*) has given extremely good results at Réunion estate, at which the Experiment Station is situated. Mr. Brooks is of the opinion that it is the best bean to grow for general purposes. While it is impossible to give an idea of the yield likely to be obtained, the few plants that were growing at the time of writing were bearing more profusely than any other variety that has been experimented with at Réunion experiment station. The dried beans are of excellent colour and size, being quite white and large, and Mr. Brooks thinks that if the cultivation of this bean were extended, it would prove the most popular one in the local market. The bean is grown on supports consisting of branched pieces of bamboo about 8 feet high, inserted in the ground; these supports are quickly covered by the vines. Up to the present, the plants have remained free from insect attack as well as from the disease known as leaf rust, which is fairly common with some varieties of beans. It may be added that favourable reports regarding the Madagascar bean have also been received from Mr. Robson, Curator of the Experiment Station, Montserrat.

The live-stock industry has contributed to the industrial revenue of Canada an aggregate of exports, for the fiscal year ending March 31, 1916, to the value of \$105,919,190. This averages a return of over 2 million dollars per week. For the fiscal years ending March 31, 1913, 1914, and 1915 the animal produce exports have totalled, respectively, \$45,773,227, \$54,612,072 and \$76,956,002. Thus, within the period of the war, the exports of animals and animal products have doubled, while for the four-year period they have increased practically 150 per cent. (*Bulletin No. 246*, Ontario Agricultural College.)



DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

BARBADOS. From the fortnightly report of the *Agricultural Reporter* of June 16, it appears that the showery weather with which May closed did not continue during the early days of June, and vegetation again began to feel the lack of moisture. Between the 7th and the 10th, however, a total of nearly an inch was registered in Bridgetown. In the extreme south of the island rain was still needed, for the surface soil was still dry, and planting of every kind was at a standstill throughout the island; there could be no rigorous start until heavy and general rains had fallen. Good rains, however, fell towards the end of this month.

Some progress has been made with the uprooting of cane stumps, forking and the opening of cane holes preparatory to planting, so that, with the first heavy rain, there might be no delay in putting in provisions. Where the crops had been completed, ploughing was becoming fairly general and attention was being paid to the application of farmyard manure to low plant canes or to fields in which yams had been planted. The potatoes planted with the showers during the latter half of May were making satisfactory progress, and the Indian corn and imphee sown at that time were also growing apace with the assistance of the June showers. Around the sea-board where the weather had not been so favourable, rain was urgently needed to prevent a stunt. Indian corn, in particular, could not long resist a drought, and a short period of adverse weather would have prevented it making a good return. The yield of corn will this year be poor, and buyers have been content to pay \$4.00 a bushel for planting purposes. During the next fortnight, with but few exceptions, reaping was expected to cease in every parish. Some of the estates still grinding had prolonged their ripening season so as to keep a supply of fodder for the animals. The pastures were not yet ready and cane shoots would not be abundant. Cane fodder had in Bridgetown been retailed as high as 42c. per 100 lb. Owing to depreciation in the juice, some estates, which were making centrifugal muscovado, have during the past fortnight, turned their attention to syrup. The increase in the number of rotten canes had to some extent been responsible for this. This year may be termed a syrup and muscovado year. For these there has been a steady demand, while for crystals the market has often been dull. The shortage of the crops in some districts together with the good price of syrup reduced the output of the factories this year. The greatest difficulty has been experienced by factories in either renewing or repairing any part of their machinery.

MONTSERRAT. Rains at the end of the month allowed a start to be made with the planting of plots in the Experiment Stations, writes Mr. W. Robson the Curator, in his report for May, including sweet potatoes, ground nuts, papaws and beans. The best yield obtained from the three plots planted in Ajowan was at the rate of 1,128 lb. of clean seeds per acre, on a piece of particularly good soil. The plot of Anguilla pigeon pea ($\frac{1}{10}$ -acre) yielded at the rate of 1,430 lb. of dry shelled peas per acre. Seeds of selected plants will be

grown in future. A fair supply of seeds of the Madagascar bean was obtained, as well as of *Hyoscyamus muticus*. Three distillations of bay leaves were made, in one of which seawater was used in the still without any apparent increase in yield.

Regarding staple crops it is stated that the earliest planted cotton (early March) suffered from want of rain, and until late in the month there was no opportunity of completing the planting of the area prepared for cotton, or of supplying the earlier planted fields. The northern district, as usual, seemed to have suffered the most from shortage of rain. The approximate area grown in cotton in 1916 was now found to have been 1,997 acres, with an average yield of lint at the rate of 156 lb. per acre. The percentage of stained cotton was 7.7, with considerable variation in different districts. The bay oil distilled from the experiment plot and shipped to London in October fetched 13s per lb. and was reported to be of excellent quality. Supplies of seed of the Ajowan plant were sent both to the Imperial Institute, London, and to the Government Laboratory, Antigua, for analysis. Seeds of Galba were sown across one of the Dagenham cotton fields to form a demonstration wind-break. The accounts of the Montserrat Onion Growers' Association having been closed, it was possible to make a total payment of 3.39c. per lb. of onions delivered by growers, compared with 2.45c. in the previous year. The emigration of labourers from the island, says Mr. Robson, is at present a source of considerable concern. The destination of the emigrants appears to be chiefly the United States of America and San Domingo. A special meeting of the Agricultural Society was about to be called to consider the local food supply problem. The rainfall for the month recorded at Grove Station was 3.12 inches, most of which fell during the last week of the month. The total rainfall for the year is 16.70 inches.

ANTIGUA. During the month of May the crops on the various plots in the Experiment Station were reaped, and the cultivation of the cane plots at Skerretts was commenced. Plant distribution included—sisal 500, henequen 600, miscellaneous 11. In addition, 1,405 lb. of cotton seed were sent out. In the Botanic Gardens all new sugar-cane seedlings were planted out during the month, and in addition to ordinary routine operations, a considerable amount of work was done in the nursery in connexion with the raising of bay and eucalyptus plants.

In his observations relating to staple crops, the Curator (Mr. T. Jackson) states that the cane crop throughout the island was ripening very rapidly, and the young cane crops required rain. Approximately 200 acres of cotton had been planted in the island to date; this also needed rain. The cultivation of land on estates was being rapidly pressed forward. A new spraying tank had been erected at Gambles, and was being regularly used for the spraying of cattle with cattle dip, for the control of ticks. The planting of sisal was continued in the windward district of the island.

Experiments in making sweet potato flour for mixing with wheaten flour for making bread were being conducted. The selecting of cotton seed of pedigree strains was continued. Work connected with the school garden attached to the Antigua Grammar School was now in charge of an officer attached to the Department. Rainfall for the month was 2.18 inches; for the year 10.13 inches. At the time of writing, adds Mr. Jackson, rain was required in most parts of the island.

ST. KITTS. In his report for the month of May, the Agricultural Superintendent (Mr. F. R. Shepherd) records the planting of various crops in the several plots in the Experi-

ment Stations. Plant distribution comprised 1,200 sweet potato cuttings, 170 lb. cotton seed, 55 ornamental and 300 cuttings. During the early part of the month much watering was needed owing to drought. Showers during the latter part of the month had much improved the condition of the plants.

The reaping of the old cane crop was rapidly progressing, the quality of the juice still maintaining a high standard. The young cane crop had felt the want of rain, and the later planted canes were very backward. The showers during the latter part of the month, it was hoped, would improve the condition of affairs. Ten thousands plants of the cane B.147, purchased from an estate by the Agricultural Department, were sent to a planter in Dominica for planting. Cotton had been largely planted during the month and the young plants presented a very healthy appearance. The greater part has been seed from the Experiment station; the remainder, the best local seed.

The Agricultural Superintendent was on leave during the month, his duties being performed by the Chemical Assistant. The rainfall for the month was 2.11 inches; for the year, 10.31 inches.

Attached to this report is a summary of work performed at the Laboratory during the month; this included the completion of the sugar-cane experiments and calculation of results; analysis of fifteen samples of milk from the Inspector of Police; analysis of one sample of muscovado sugar; analysis of four samples of 'fancy molasses'; and analysis of soils.

NEVIS. Mr. W. I. Howell, reporting on work in the Experiment Stations during the month of May, states that the plots had been kept weeded and were in good order, and mentions the crops that have been planted out in the several plots, including the following food crops: Indian corn, Para peas, black-eye peas, and sweet potatoes. Plant distribution comprised 142 bags sweet potato cuttings, 5,050 cassava cuttings, 15 lb. black-eye peas, 2 lb. Indian corn, 10 shade trees, and 429 lb. cotton seed.

Concerning staple crops, the Agricultural Instructor says that the weather during the latter half of the month being very favourable, a large acreage of cotton was planted and some of the fields had made a very good stand. Preparation was being hurried on with a view to taking advantage of the weather. The showers were very welcome to the young canes which were very much in need of rain. Reaping of the old cane crop was still in progress; in some places operations were hindered by shortage of labour. A large acreage had been planted in sweet potatoes and peas; preparation and planting were still in progress. Onion growers had been paid at the rate of 2.78c. per lb. for all onions delivered at the curing house. A meeting of planters was held on May 17, under the presidency of His Honour the Administrator, with the object of inducing planters to grow provision crops so as to be able to supply home-grown provisions for local consumption, in case the supply of imported foodstuffs be further reduced, or altogether cut off. Rainfall for the month was 4.27 inches; for the year to date, 12.58 inches.

DEPARTMENT NEWS.

Mr. W. Nowell, D.I.C., Mycologist on the staff of the Imperial Department of Agriculture, has left Barbados for Dominica with the object of continuing investigations in that island in regard to plant diseases. Mr. Nowell is expected to return to Barbados about July 11.

ANTIGUA AND ST. KITTS CENTRAL SUGAR FACTORIES.

The notes on the Antigua and St. Kitts Central Sugar Factories, which appeared in the *Agricultural News* for March 24, 1917 (Vol. XVI, No. 389, p. 83) did not present a clear and adequate account of the work and results in those establishments. For a detailed and critical review of the work of these factories for 1916, the reader is referred to the *Agricultural News* for November 4, 1916 (Vol. XV, No. 379, pp. 356 and 357). From the figures given in that article, it will be seen that the work of the two factories is remarkably similar in character and is of a very high order, closely approaching what is economically possible.

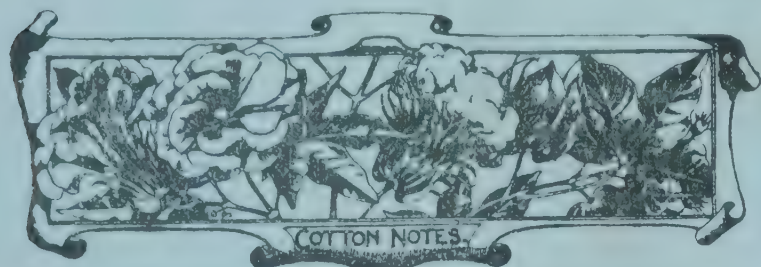
In regard to the Antigua factory, a few observations concerning administration and financial results may here be added as a useful and interesting supplement to the purely technical figures of manufacture contained in the review referred to above.

In the first place the supply of canes to the factory was derived from the following sources: the Original Contractors supplied 33,968 tons for which 30s. 1½d. per ton was paid; this price included the bonus. From the New Contractors 72,567 tons were bought at the rate of 24s. 11¼d. per ton. Peasant cultivations supplied 5,929 tons and were paid 19s. 7¼d. per ton. This gives a total of 112,464 tons, which is 108 tons above the total registered in the Chemist's report: this difference arises from an allowance made for Uba canes.

The report of the Directors, from which these figures have been obtained, shows that the factory charges, which include such items as salaries and wages, repairs and taxes, were £2 11s. 11d. per ton of sugar made; railway transport charges were 10s. 3¾d. per ton of sugar; while administration charges were 1s. 10½d. per ton of sugar. The number of tons of sugar made in 1916 was 12,371, and the total proceeds from this sugar and the molasses produced was £228,063 9s. 3d.

In the case of the St. Kitts factory, 91,132 tons of canes were purchased from the Original Contractors and 10,116 from Outside Suppliers—making a total of 101,248 tons of canes bought. The net proceeds of sugar, etc., were £215,668. In the case of both factories, the season's results financially and technically, were highly successful.

Transportation of Bay Seed to Egypt.—Last August, a quantity of Bay seed was sent from the Botanic Station, Montserrat, to Egypt and East Africa, and in connexion with the seed sent to Egypt interesting results have now to be recorded. The seed was sent packed in two different ways. First of all, 5½ oz. of seed were despatched in damp charcoal, 4 oz. of water being added to 1 lb. of charcoal; shortly after, two more tins were sent, one with water at 3 oz. to 1 lb. of charcoal, and the other at 2 oz. to 1 lb. of charcoal. The seed was received in Egypt towards the end of September. Those packed in damp charcoal containing the larger proportion of water germinated en route, but seedlings were saved and have been established. The seed in the other packages containing lesser amounts of water arrived without having germinated, but on being sown no plants developed. No particulars concerning the supply of seed sent to East Africa have yet been received. It will be remembered that Bay seed in the ordinary way very quickly loses its vitality. The method of sending germinating seed is of interest, for it is that which is made use of in sending Hevea seed by post over long distances, and similarly in transporting living sugar-cane.



COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending June 2, 1917, is as follows:—

ISLANDS. The market is closed for the season, as the crop has all been marketed and sold. The new crop (1917-18) will not come to market before October.

GEORGIAS AND FLORIDAS. The receipts for the past fortnight have been only 14 bales and the sales 133 bales, made by an exporter who succeeded in placing from the cotton they had on hand. The market has been very dull, Factors unable to get any one interested in their small offerings. They are, however, continuing to hold for previous prices. We therefore repeat last quotations.

We quote:—

GEORGIAS AND FLORIDAS.

Extra Choice & Fancy 70c = 72½c. landed, including war risk.
Choice & Extra Choice 69c. = 71½c. " " " "
Extra Fine & Choice 67c. = 69½c. " " " "

The exports from Savannah for the past fortnight were, 51 bales to Southern Mills, 20 bales to Liverpool, and from Jacksonville 573 bales to Northern Mills.

The stock in Savannah is 1,549 bales, of which Factors hold only about 530 bales to 600 bales, composed almost entirely of the lower grades.

CROP ADVICES. The crop in all three of the States, although about two weeks backward, is reported to be doing fairly well, but it is too early as yet to make estimates of the final outturn.

COTTON EXPORTS FROM THE WEST INDIES.

The following shows the quantity and value of Sea Island cotton exported from the West Indies during the quarter ended March 31, 1917:—

Colony.	Quantity, lb.	Value, £.
Barbados	53,515	6,568
St. Vincent	68,510	8,320
Antigua	16,500	2,166
Montserrat	173,936*	21,900
St. Kitts	47,622	5,953
Nevis	104,892	13,112
Anguilla	35,965	4,496
Virgin Islands	1,300	16
	502,240	62,541

*159,548 lb. valued at 2s. 7½d. per lb.; 14,388 lb. stains, valued at 1s. 4d. per lb.

HURRICANE WARNINGS.

The approach of the hurricane season makes it desirable to publish the following information concerning the nature, and the signs which indicate the approach of these storms in the West Indies.

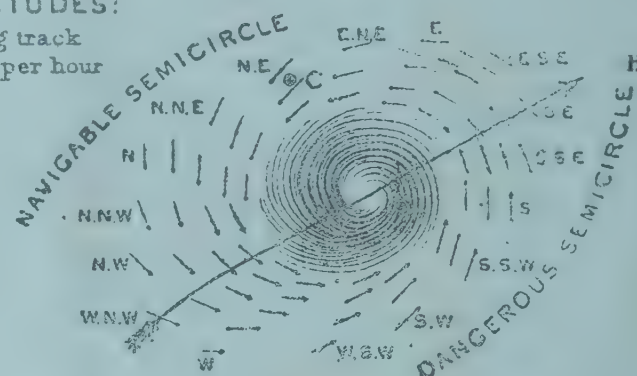
It is urged that instruction in connexion with this subject should be given in all secondary schools in the Windward and Leeward Islands, and possibly in the primary schools as well. One or two lessons given in each year immediately before the hurricane season should prove of real service.

It is first desirable to point out the nature of a hurricane and its path of transition. With this object the diagrams below have been reproduced, having first appeared in this Journal in connexion with an editorial on hurricanes (see *Agricultural News*, Vol. VIII, p. 209).

The lowest figure represents the storm during its passage through the West Indian islands, before it takes a sweep round to the north or west of Cuba, into the North Atlantic (top figure).

IN HIGH LATITUDES:

Velocity along track
20 to 30 miles per hour



IN MIDDLE LATITUDES: STORM RECURVING:

Velocity along track
5 to 10 miles per hour

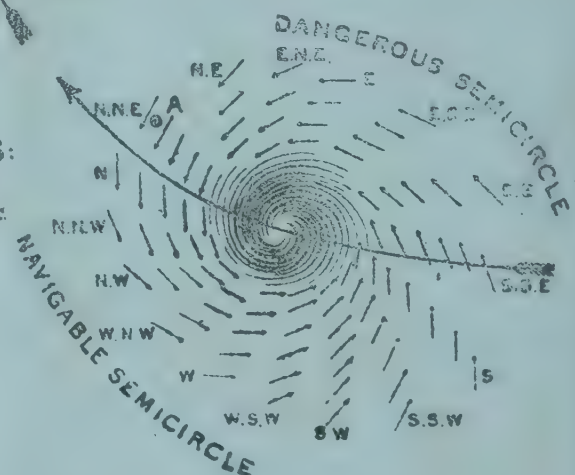


NOTE: Hurricanes recurve about the following latitudes:

June and Oct., lat. 20° to 23° N.
July and Sept., lat. 27° to 29° N.
August, lat. 30° to 33° N.

IN LOW LATITUDES:

Velocity along track
about 17 miles per hour



The motion of rotation and the motion of translation may be well understood by spinning a top and giving it a counter-clock rotation. It will be seen that while the rotation may be very rapid round the centre, the top itself may remain in one spot. This rotation corresponds with the violent wind of the hurricane. By noting the direction in which any part of the edge of the spinning top is moving in relation

to the centre, it will be obvious that the position of the centre is at right angles to this line of movement. Consequently in a hurricane, if the observer stands facing the wind, the centre of the storm is on his right-hand. He can trace the movement of the centre by noting the change in the direction from which the wind blows.

The reader will find it instructive to take a number of points on the lowest section of the diagram, which corresponds with West Indian conditions, and note (a) the direction of this wind (the arrows fly with the wind), and (b) the relative position of the centre.

Reverting to the spinning top, while it may remain spinning on one spot, it may, on the other hand, move from this; there will then be two motions: a spin and a progressive motion; this latter is represented in the hurricane by the movement of the revolving storm from one place to another. Usually West Indian hurricanes approach the islands from the Atlantic, that is, from East or ESE, and travel towards Cuba and the American coast where the path curves northward and finally eastward, so that the storms pass out into the north Atlantic.

This progressive motion across the West Indian islands is comparatively slow, ranging from about 7 to 14 miles an hour.

An observer therefore, knowing the general trend of the hurricane's path may, by observing the direction of the wind and its changes, form a very good idea of his position as regards the centre, and whether the centre is coming directly towards him, or is passing on the north or on the south side of him.

If the direction of this wind remains fairly constant in a direction NNE or N or NNW, the probability is that the centre is directly approaching. Conversely when the wind direction remains SE, ESE, and S, the centre is moving directly away.

Where the motion of the wind changes from NE to ENE, E and ESE, the centre is passing on the south side of the observer.

When the direction changes from NW to WNW, S and WSW, the centre is passing to the north of the observer.

These rules apply in the West Indies only: they should be checked by making trial observations on the lowest figure in the diagram until the matter is clearly understood. From these an observer can anticipate fairly exactly what may be expected to happen, and—a matter of great importance—he is able to recognize when the centre has passed and the storm may be expected to begin to abate.

The violence of the wind increases as one approaches the centre: at the centre itself there is an area of calm. When this centre passes over any particular place the direction of the wind suddenly changes, and the wind after its passing begins to blow violently from exactly the opposite direction from that from which it blew before: this is a feature of considerable importance in West Indian hurricanes. The barometer falls rapidly as one gets nearer and nearer the centre, so that the barometer affords a means of marking the approach of the centre and the probable distance that it is away, while the changes in the direction of the wind afford clear indications of the line along which the centre is travelling.

In judging the direction of the wind it is best to note the direction in which the lower clouds are moving: this is better than observing weathercocks or flags.

It is worth noting that in the West Indies—the rule does not apply elsewhere—in describing the direction of the wind, when one employs the term south, the centre has passed and conditions may be expected to improve. This may be confirmed by noting the position of the centre in relation to

such winds as SSW or SE, or any in which the term south occurs.

On the other hand, the dangerous position is indicated by those winds which involve the use of the term north, as may be seen by noting what is implied by such winds as NNE, or N or NE.

The first indication of an approaching storm is frequently a heavy swell, breaking in heavy surf along the shore; these waves come from the direction of the centre of the approaching storm. They may be noticed many hours, sometimes a day or two, before the storm passes.

The next indication is usually some disturbance and unusual movement amongst the higher clouds, coupled with unusual light, often a coppery glare, at sunrise or sunset, particularly the latter: the wind is then unusually irregular and puffy, and the atmosphere moist and oppressive. The next indication is a fall in the barometer, and then the observer may feel certain that a cyclone is in existence.

It is worth noting that cyclones may, and do, exist in which the wind is rotating with only moderate velocity: they present all the characters here referred to, save that not having violent winds they do not damage: it is only when the wind blows violently that a cyclone becomes a hurricane.

These facts are readily grasped and appreciated; a knowledge of them is of great service to West Indians, enabling them to take such precautions as are possible to protect themselves and their property from approaching storms, and relieving their minds of great anxiety when they are able to recognize that a threatened storm has passed.

SWEET POTATOES IN ENGLAND.

In reporting upon some sweet potatoes recently sent by the Jamaica Agricultural Society, through the West India Committee, to the Food Committee of the Royal Society, the Secretary wrote, as appears in the *West India Committee Circular* of May 17, 1917: 'The sweet potatoes which you were good enough to send were tried by various members of the Committee, and the unanimous conclusion was that they would prove a very acceptable foodstuff, and one which people would readily get used to. But I regret to say there are two difficulties in the way of getting supplies to this country. The first is the bad keeping qualities of the sweet potato. Within a fortnight of their arrival here, the greater number of them had gone rotten. This was not due to careless storage. The crates, when they were received, were simply opened and put in a cool place. A further difficulty, in view of the small tonnage available, is the large water content—namely, 55 per cent.' Apart from other considerations the increase in the price of foodstuffs in the West Indies, which has been accentuated since the entry of the United States into the war, makes it most improbable that there will be any surplus for exportation.

It is not generally known that the sweet potato (*Batatas edulis*), which is probably of American origin, was introduced by Gerard into England from Spain in 1597, about the same time as the potato was introduced from Virginia. On account of the great yield of the sweet potato experiments have been made to grow it in temperate climates. Sweet potatoes are grown as a field crop in Algeria, Spain and the Canaries, whence they are sometimes imported in small quantities into the United Kingdom, where they are offered for sale in the best-rate vegetable shops. Their cultivation with the aid of artificial heat has been attempted in Paris without, however, much success, and it is useless to try to grow them as a garden crop in England.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue deals in a general way with the question of the production of foodstuffs in the West Indies.

In connexion with the editorial several notes describing local action already taken in the West Indies, on pages 194 and 195, will be read with interest.

In view of the approach of the hurricane season, an article explaining the nature and warnings of cyclones is published on page 198.

Insect Notes in this issue deal with soil grubs and also with slugs causing considerable damage. On pages 206 and 207 will be found two important articles dealing with the mongoose and with rats, respectively.

Pure and Applied Science.

In his work, 'Discovery or the Spirit and Service of Science', Professor A. A. Gregory draws, as is observed in the *Botanical Journal* for March, a distinction between pure and applied science. The aim of the one is to acquire knowledge; that of the other, to apply to the direct service of man the knowledge so acquired. The former is altruistic, the latter largely mercenary. The one leads to poverty and obscurity; the other to wealth and fame. Both are equally necessary, for the student of pure science has always, with certain marked exceptions been unpractical, but both are not equally rewarded. Yet without the scientist—the man who is ever extending our knowledge of the laws and facts of the universe—there can be no progress. Of all the men who devote themselves to the application of science, the agriculturist is in many cases the slowest to take advantage of the discoveries and teachings of science.

'To the husbandman in general, science means theory and his own experience fact. He prides himself on being a practical man and regards all scientific work as unpractical, though whatever is known of the exact relation between cause and effect in all branches of agriculture, and whenever fact can be placed against opinion as regards diseases of animals and plants, the credit belongs to the scientific investigator and not to the actual cultivator of the soil.'

Logarithms.

The Tercentenary of the death of John Napier, the inventor of logarithms, who died April 4, 1617, helps to remind us how little interest is as a rule paid to the lives of our great men of science, for, both by the brilliance of his genius and by the influence of his discovery on succeeding generations, Napier takes high rank among the greatest of Scotchmen. Few results of far-reaching importance have had a greater influence on progress than logarithms, which are employed in the everyday routine work of the engineer, the surveyor, the actuary, and in scientific work generally.

Everyone knows that the most tedious operations to be performed in arithmetical calculations are those that involve multiplication and division: addition and subtraction are, comparatively speaking, simple. Now, if a person is in possession of a table of logarithms and knows how to use it, any calculation involving multiplication or division can be converted into one involving, respectively, addition and subtraction. Similarly, finding the power or the root of a number is merely a question of multiplication or division. An example, given in the May number of *Chamber's Journal*, shows how much time is saved by utilizing the process invented by Napier. Suppose we wish to find what answer we should get by multiplying 675 by 873. All we have to do is to turn up our table of logarithms, which tells that the logarithm of 675 is 2.8293038, and that of 873 is 2.9410142. These numbers

have to be added since our original numbers had to be multiplied. Our tables tell that the number which has for its logarithm 5.770318—the answer to the addition—is 589,275, which is the answer desired.

It is well to see how the process can assist a business man, say, in calculating what £3,520 would amount to in twenty years at 4 per cent. per annum compound interest. If this had to be worked out by finding the interest year by year, it would probably take a couple of hours. By Napier's invention we proceed thus: Take the logarithm of 1.04; multiply that by 20; add to the answer the logarithm of 3,520; find from the tables the number which has this number for its logarithm, and the answer is there.

Planters in the West Indies have oftentimes to measure off plots of land for cultivation and for other purposes, and would find a knowledge of logarithms of great assistance in this as well as in other measurements, and in money calculations.

All Experiment Workers should make themselves familiar with the use of logarithms.

The High Price of Agriculture.

In *Bulletin No. 246* of the Ontario Agricultural College (for January 1917) are given particulars of the exports of agricultural produce from the Dominion for the fiscal year 1915-16. Considering the value of the exports of animal produce with that of the exports of agricultural produce, the aggregate for the fiscal year ending March 31, 1916, amounted to \$372,394,380, as compared with a total export value for the same period, of manufactures, including munitions, of \$250,052,223. In other words, the total export value of agricultural produce is practically one and one-half times as great as the value of the exports of manufactures, including munitions of war.

Pressing the comparison still further, the aggregate of exports from all sources, including mining, fishing, lumbering, manufactures and agriculture, for the fiscal year 1915-16, amounted to \$779,300,070. Of this the total export value of animal and agricultural products amounted to 48 per cent. For the fiscal years 1911-12, 1912-13, 1913-14 and 1914-15, the export value of animal and agricultural products amounted respectively to 53 per cent., 51 per cent., 57 per cent., and 54 per cent. In other words, during the last five fiscal years the exports of agriculture yielded an industrial revenue to the country of more than half—to be exact, 52.6 per cent.—of the total return from all sources combined. Again, the aggregate export trade for the first five months, April-August, of the current fiscal year, amounted to \$443,254,333, of which \$222,176,467 represents the proportionate value of agricultural products, or slightly over 50 per cent. of the total exports.

Bearing in mind the fact that the great increase in the export value of manufactured products is attributable almost entirely to the manufacture of war munitions, the financial return yielded to the country by agriculture is all the more creditable.

Molasses as a Fertilizer.

With reference to the article in the *Agricultural News* of June 16, p. 179, dealing with the possibility of usefully employing the waste molasses obtained in cane-sugar factories as a fertilizer for cane land, an article in the *International Sugar Journal* for April is of interest. According to a patent recently taken out in North Queensland, molasses can be cheaply treated so as to reduce largely its weight and character, hence concentrating the valuable manurial ash content and at the same time destroying its fermentable sugars, which are converted into humus-like bodies of undoubted manurial value and beneficial to the physical qualities of probably all soils.

This treatment, which will obviate, it is claimed, the disadvantages attending the application of molasses to the soil, consists, it appears, in evaporating and partially or fully carbonizing the molasses. If, for example, the process be carried only to the stage of the destruction of sugar, the potash content if an average molasses be used will be about 7 per cent., equal practically to 14 per cent. of commercial sulphate of potash. If, however, it be taken to the full stage of carbonization, the potash content will be about 20 per cent. of commercial sulphate. If, again, it be pushed to the final stage, the percentage of potash will represent approximately that of commercial sulphate.

Drought and Food Supplies in St. Lucia.

So critical had become the situation in St. Lucia in consequence of the effects of the drought on efforts to increase the local food supply in that island that the Agricultural Superintendent, in a Minute to the Administrator on May 28, urged that the members of the Food Committee should be informed of the shortage and that on no account should food provisions either in a raw or manufactured state be allowed to be exported. Every effort was to be made by the officers to push the replanting of sweet potatoes throughout the island as soon as the rains set in. In consequence of this notice a Government Notice was published recommending planters and peasants to pay special attention to the replanting, as soon as weather conditions were favourable, of large areas of sweet potatoes, inasmuch as sweet potatoes produce profitable crops in three or four months, whereas cassava requires ten to twelve months before it can be reaped.

The Commissioner of Agriculture in reply to the report of the Agricultural Superintendent draws the latter's attention to what is being done in St. Vincent with the corn drier and granary. In view of their high nitrogenous value, the increased production of beans and peas is also advised.



INSECT NOTES.

SOME SOIL GRUBS IN THE WEST INDIES.

In the last issue of the *Agricultural News* there were some notes on root-borer grubs under the above title, and additional notes on the subject of hard backs were promised for this issue.

The beetles known as hard backs in these islands belong to the family Scarabaeidae, and the different species of these beetles are grouped for the most part under two of the sub-divisions of this family. *Phytalus smithi* and the species of *Lachnosterna* belong to the Melolonthids, the larvae of which are root-trimmers; while the common *Ligyris tumulosus*, and species of *Cyclocephala*, *Strategus* and other related genera are included under the Dynastids, some of which are scavengers in the larval stage.

A reference to the *Agricultural News*, Vol. XII, No. 290, p. 186, will give the classification, distribution, and habits of the grubs and adults of the commoner species of hard backs occurring in the West Indies, and from this list it will be seen that some of these species are quite local in their distribution, and are found in only one or two islands. This local distribution is especially noticeable in the case of the genera *Lachnosterna* and *Cyclocephala*. The systematic relationships of the species of *Lachnosterna* and allied genera occurring in the West Indies have never been thoroughly established, and the Imperial Bureau of Entomology in London has recently asked for as large a series as possible of these beetles from the various islands in order to facilitate the further study of this group by experts. These beetles are still emerging from the soils in which as grubs they were feeding on the roots of such crops as sugar-cane and Indian corn, or on decaying vegetable matter. With the well-known exception of *Ligyris tumulosus*, the common blackish-brown hard back, they are not usually attracted to lights, but must be sought out in the fields at night. During the day they hide in the soil, or among the leaves of plants growing near the cane fields, and come out at night to feed on the leaves of plants.

References have often been made to hard-back grubs and beetles in the *Agricultural News*, and an account of the various species can be found in Pamphlet No. 73, mentioned in the last issue in connexion with root borers. The two most serious pests at the present time are the Barbados brown hard back (*Phytalus smithi*), and the Antigua brown hard back, which is an unidentified species of *Lachnosterna*. *Phytalus* is very common in some districts of Barbados this season, and a vigorous campaign is being carried out on some estates. The adults are being collected by the thousands in the fields at night by labourers carrying lights, and vessels in which to put the beetles.

In the last Annual Report of the Barbados Department of Agriculture, which was reviewed in the *Agricultural News* for May 19, 1917, reference was made to the fact that this brown hard back seems to be controlled by its parasite (*Tiphia parallela*) in some localities, while there are other districts where *Phytalus* occurs without its parasite. Efforts are being made to introduce *Tiphia* into localities where it is needed, but it will be some time before it becomes established.

Meanwhile the collection of adults seems to be the only practicable method of control at the present time.

The Antigua brown hard back was mentioned in the *Agricultural News* for May 5, 1917, and some of the control measures suggested last year by Mr. Ballou were given. No reports of this pest have been received so far this season, so that nothing further can be said about it for the present.

J.C.H.

SLUGS.

Within recent years slugs have been attracting considerable attention in these islands as pests of many estate and garden crops. Reports from some of the Agricultural Officers show that the 'leather jacket', or the 'palute' (as the slug is sometimes termed) is most in evidence as soon as the first rains have fallen in May or June, but that it is present more or less all the year round.

FOOD-PLANTS. In Dominica, besides attacking such crops as sweet potatoes, yams, tania, cabbages, melons, cucumbers, ground nuts, etc., these molluscs have also injured Para rubber seedlings, and stripped young budded citrus plants. In Montserrat they have recently been reported as a pest of cotton, being abundant on a small experiment plot at the Botanic Station. The above list of food-plants is by no means complete, but is fairly representative of many of the islands.

HABITS. Slugs like places where the soil is kept cool and moist by rank growths of wild or cultivated vegetation, by mulches, by heaps of weeds or trash, by flat stones or boards. They hide in such places during the day and come out after nightfall to feed, returning to their hiding places in the early morning. The eggs are laid in damp situations and a large number of individuals may be produced in a comparatively small area. When these have grown enough they make a raid on the nearest vegetable gardens and play havoc with the tender young plants. These outbreaks occur suddenly and are of short duration, but are severe while they last.

Mr. Robson, the Curator of the Botanic Station in Montserrat, has made some notes on a recent outbreak of this pest which took place on a $\frac{1}{4}$ -acre experiment plot at the Station. In this instance, cotton followed sugar-cane, and after the cane stumps had been dug out in March the trash was ranged and the space between the rows flat-forked. The seeds were planted on April 6, and a week later it was noticed that the young seedlings were being injured, and slugs were suspected. Beginning on the night of April 13, collections were made by lamp-light nearly every night till May 10, by which time all further danger from the slugs seemed to be over. During this period a total of 8,343 slugs was collected on the $\frac{1}{4}$ -acre plot, and it was noticed that there was marked increase of slugs after rain.

This is the first time that cotton has been recorded as a food-plant of slugs, and it was not eaten very readily. Mr. Robson found that the young stems were sometimes eaten through below the seed-leaves and the leaves themselves left on the ground, while on older plants the skin on one side of the stem might be eaten away.

CONTROL MEASURES.

There are no really satisfactory remedies against slugs, but the following are some of the methods of control that have been employed in different places.

ERADICATION OF BREEDING PLACES. As mentioned above, slugs usually breed where the soil is kept moist by a covering of vegetation. The weed-covered banks of open drains or ditches are often favourite breeding places, and such places should be thinned out and the soil raked over to expose any eggs hidden there to a drying out in the sun.

HAND-COLLECTING. If the breeding places cannot be found or if it is impracticable to eradicate them, then hand-collecting should be tried. This can be carried out at night by artificial light after the slugs have come out to feed, or in the early morning before they have returned to their hiding places. Mr. Joseph Jones, the Curator of the Botanic Gardens in Dominica, writes that when this pest appears in great numbers it is usual to get women labourers to turn out at dawn, each with a slender sharp-pointed stake, and to skewer the slugs before they return to shelter.

TRAPS. Put down pieces of board in the infested places with room beneath for the slugs to collect. To make these traps more attractive, smear the underside of the boards with fat, rancid butter, stale beer, or fermenting molasses. Mr. Jones mentions that in Dominica slugs are said to be fond of bananas, but can only get them when a stem with an immature bunch has fallen. The stem is then left on the ground to allow the bunch of bananas to 'fill'. The slugs cannot eat their way through the skin, but if the skin becomes broken they are quickly attracted. This suggests the use of pieces of banana as an attractive bait for use under the boards or with other similar traps. Examine these traps during the day and kill the slugs which have collected under them.

DUCKS. Some estates in Dominica keep ducks to control slugs with good results.

LIME. It has been found in Dominica that slugs may be kept away from individual plants or small beds by placing a ring of lime round the plant or bed.

POISONS. As far as is known at present, practically no experiments have been made in these islands with poisons, either in the shape of sprays or poisoned baits, so that nothing definite can be said as to their value. It has been observed in Dominica that slugs will not touch freshly gathered leaves of tania which have been dusted with Paris green and lime, so that it seems likely that they may avoid poisons unless these are attractively disguised in some form of bait. Experiments with various poisoned baits will be made later.

J.C.H.

A WEED DANGEROUS TO STOCK.

Mr. A. J. Brooks, Agricultural Superintendent, St. Lucia, reports that two instances have recently come to his notice of apparently healthy cattle, two in each case, having suddenly died. After enquiring into the circumstances Mr. Brooks believes that the cause of death was poisoning from the ingestion of the weed *Spigelia anthelmia*. In the first case this plant had been accidentally fed to the animals in bundles of hand-cut fodder. One large animal died within three hours, the other some hours later. In the second case the animals were found dead in a pasture in which the weed is common.

The dangerous properties of the plant are well known. The vernacular name applied to it in St. Lucia is *breville*, in some islands *brinnie*, obviously corruptions of *Brinnvillière* or *herbe Brinnvilliers*, names current in the French islands and having reference to the notorious Marchioness of Brinliers, executed in Paris in 1676. In Barbados the plant is known as 'waterweed'. Other names met with are *poudre à vers*, *herbe poison*, wormweed, and Demerara pink-root.

Twenty-nine years ago the *Kew Bulletin* recorded the receipt at Kew of specimens of this plant from St. Vincent, accompanied by the information that it is poisonous to cattle, sheep, and goats, proving fatal in two or three hours. It is there stated to be commonly distributed throughout the West Indies and Tropical America.

The plant is common as a low-growing weed in gardens, arable land, waste places in the neighbourhood of cultivations, and in some pastures. In form its most prominent character is the arrangement of its four uppermost leaves in the shape of a cross, the lower (and lesser) pairs being somewhat widely separated. The leaves are slightly channelled over the veins; broad and rounded at the base, tapering off, with rather straight sides, to a point. From between the upper leaves the slender flower spikes grow up, bearing a succession of small pinkish flowers, followed by small rough doubly-spherical capsules.

It appears to be the current belief in Barbados that stock, except occasionally young animals, come to no harm from the presence of this plant on their grazing grounds, presumably because it is avoided. But the danger of including it in cut fodder is well recognized. The time for application of remedies is short, and no effective treatment has been heard of.

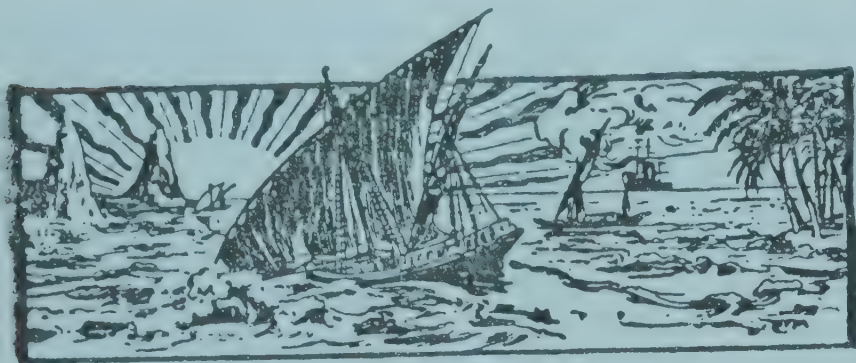
The root and plant generally have been widely used as a means for the cure of worms. Pink-root, sold for the same purpose, comes from an allied species. According to the *Treasury of Botany*, the action of these plants is also purgative and slightly narcotic, and apt to produce very unpleasant symptoms. Dimness of sight, giddiness, dilated pupils, spasms of the muscles of the eye, and even convulsions are recorded among the effects. In poisoned animals the appearance of the eye is characteristic, and is of value for diagnosis.

The elimination of the plant from feeding grounds, as suggested in the *Kew Bulletin*, would be a difficult matter, but care may at least be taken to see that those charged with the management of stock are aware of the danger of including it in cut fodder.

FARM TRACTORS.

In *The Field* of March 17, the tendency to favour separate tractors instead of composite machines is noted as deserving careful attention. The latter machines possess unquestioned advantages, but they are complicated and expensive, and there is a good deal in the argument that although a collection of independent machines has the appearance of extravagance, the aggregate cost may not be greater while the standard of efficiency is higher. The detachable tractor comes within this survey, and its use calls for immediate investigation, in view of the plans maturing for increasing the supply of oil motors.

The farm tractor occupies a somewhat peculiar position. It has not yet approached, far less attained, finality in efficiency and economic use, and it is not easy to set aside the argument, that while the state of transition lasts, it would be advisable to keep expenditure within reasonable bounds. The intention of those concerned with the development of motor traction appears to be to encourage the manufacture of cheap machines, the life of which may be short, but proportionate to the cost, say, two or three years, by which time changes may be effected that would make the introduction of a newer machine advantageous. If a more durable class of tractor were produced the buyer would be committed to a contrivance, perhaps for some years after it was out of date, unless he were prepared to scrap it before its term was ended and it had repaid the original cost. It would be difficult at the present stage of mechanical development to make a definite pronouncement upon the relative merits of the different types, but prospective employers of oil motors would do well to examine the point closely, and weigh the merits of the respective contrivances without bias. The oil motor is coming, and its arrival and efficiency will be hastened or retarded according to the manner in which it proves itself in the next few years in fulfilling the requirements of the farm.



GLEANINGS.

In the *Farm Journal* of May, advice as to carrying poultry is given. The proper way to carry a fowl is to place it under the arm, the head pointing to the rear, and the feet held firmly by the hand. The common practice of carrying fowls by the legs with the head hanging down cannot be too strongly condemned.

In the *Colonial Report* for 1914 of the Falkland Islands, which was recently published, it is stated that, apart from a small school at Darwin maintained by the Falkland Islands Company, all teaching outside Stanley is done by itinerant teachers, two being employed on their 'camp' by the Company and five by the Government in different parts of the Colony.

In the March number of the *Journal of the Jamaica Agricultural Society*, the making of coco-nut butter, as a home industry at the present time, is strongly recommended. In a recent test twelve nuts weighing 27 lb. gave 3½ lb. of butter, and the coco-nut meal left weighed 7 lb. The butter can be used for cooking, for making cakes and, where it is liked, in the place of dairy butter, while the meal is of great value for feeding poultry.

According to *Colonial Reports* (1914-15), Uganda, over 9,000 tons of cotton seed valued at £18,172 were exported from the Protectorate in the early part of the year under review, and this total would have been considerably greater, had not increased freight rates, due to war, acted adversely on trade in this product. The cultivation of plaintains, sweet potatoes, millet, maize, peas and beans was increased to meet demands made necessary by hostilities, and efforts were in hand to meet abnormal future requirements.

It will be recalled that in 1910 the chief cacao manufacturing firms in the United Kingdom decided to boycott cacao from the Portuguese islands of San Thomé and Príncipe, on the ground that it was produced under conditions closely akin to slavery. This drastic action resulted in reforms being carried out, and the Secretary of State for Foreign Affairs was able, as is stated in the *West India Committee Circular* of May 3, 1917, to express the hope that, in view of the improved conditions in those islands, the boycott would be removed.

Sugar has always been used in connexion with surgery. According to the *Veterinary Record* it has been recently used with good results. Two horses with deep wounds of the carpus, were first treated by washing with a solution of sodium chloride, and afterwards the wounds were covered with sugar. Five days later the dressings were removed when the wounds were of healthy appearance. The second dressings were removed five days after this, revealing only a superficial wound, the total recovery of which was obtained in twenty days.

Sugar cultivation and sugar manufacture in Eastern Bolivia, as reported by the British Vice-Consul in *The Board of Trade Journal* of April 12, appear to be conducted according to primitive methods. The juice is boiled in a copper cauldron until it become of the proper consistency, when it is transferred to earthenware crocks with a hole at the bottom for the molasses to drain from, and the refining is done by the claying process, as was the case in the first days of the sugar industry in the West Indies. Antiquated wooden sugar mills are still seen, and most of the iron mills are still operated by animal power.

In certain parts of Uruguay the farm buildings are a fine white colour even during the wet season. To obtain this appearance a whitewash is used, made of the sliced leaves of the Prickly Pear, which, when macerated in water for twenty-four hours produce a solution of creamy consistence. To this lime is added and well mixed in. When the solution is applied to any surface, be it wood, iron, or other material, a beautiful pearly white appearance is produced which endures through rain and frost for many years. The editor of the *Cyprus Agricultural Journal* says that the solution has been tested in Cyprus with good results. It may be noted that this use of the Prickly Pear is common in the West Indies.

At Nawabgani in Bareilly district a sugar factory has, it is reported in the *London Chamber of Commerce Journal* of March, been established by State agency as an endeavour to avoid the wasteful methods of sugar extraction, and from the first report upon the results obtained experience has shown that the mere introduction of crushing mills requiring greater bullock power would prove no advantage to the cultivators who, in most cases are too poor to purchase a costly mill. The greatest obstacles appear to be the jealousy of the sugar boilers who seem to see in the improvements offered a menace to their obsolete methods, and the stubborn resistance to innovations of any kind on the part of the native cultivator.

In *Farmer's Bulletin* 787, of the United States Department of Agriculture, the pathologist in charge of cotton and truck disease investigations of the Bureau of Plant Industry writes: 'There is little encouragement to offer to those who would attempt to introduce the culture of Sea Island cotton into any other part of the country than where it is now grown (South Carolina, Georgia, Florida). Many such trials have been made during the past hundred years and all have failed. Even in the present area the crop is losing rather than gaining ground in competition with Upland cotton, although the production of Sea Island cotton might be increased if market conditions warranted.' The chief obstacles to its extension are the scarcity of labour and the development of trucking and other more profitable industries.



SHIELD-BUDDING OF COFFEE.

In the *Philippine Agricultural Review*, the horticulturist in charge of the Lamao Experiment Station during a visit to the coffee districts in Java was surprised to find that, although in the coffee industry, seedling plantations are as a rule taken as a matter of course, a considerable acreage is planted in grafted trees. The grafting operation in Java consists in a cleft graft on young stock about the thickness of a lead pencil. The graft instead of being waxed is covered by a glass tube to exclude water. It has to be remembered that from a given number of scions twice as many buds may be obtained as grafts—a fact in connexion with coffee which is worthy of more than ordinary attention, when it is borne in mind that grafted trees with normal habit are obtained only when scions are taken from stems or the vertical growth of the suckers, scions from the horizontal branches producing plants of dwarf and spreading habit. It follows that the increase of grafted plants from a single tree is necessarily very slow during several years.

In a course of some experiments in budding and grafting coffee at Lamao in 1915 and 1916, when waxed tape was exclusively used, the net results indicated that in the case of cleft grafting, the use of tape and wax is a decided improvement upon the use of unwaxed material supplemented by a glass tube covering the graft.

Shield-budding is simpler than grafting and can be performed more rapidly. Good success has been obtained by using well matured, green, non-petioled budwood with buds 3.5 to 4 centimetres long; the age and appearance of the stock at the point of insertion are apparently important; the buds should be entirely covered with waxed tape.

AGRICULTURAL RECONSTRUCTION IN ENGLAND.

In the April number of the *Journal of the Board of Agriculture* (of England and Wales), the principal article deals with the question of agricultural reconstruction, which as a matter of paramount Imperial importance emphasized of late by the submarine menace, has been engaging public attention throughout the United Kingdom, and a complete revolution in the agricultural policy of the home country appears to be in contemplation.

In 1916, in view of the need of increasing home-grown food supplies in the interest of national security, a sub-Committee of the Reconstruction Committee was appointed to consider and report upon the methods for effecting this increase, and an interim report upon those aspects of the question which required legislation was submitted in January.

The report states that, by the adoption of a complete policy by the Government, and by a steady persistence in it, a large proportion of the foodstuffs now imported could be produced in the United Kingdom, and that a large addition might be made to the production of cereals and potatoes, not only without a diminution of the production of milk and

wheat but with an actual accompanying increase of that production. The policy to be adopted embraces among other things, a more intensive policy of grass and arable lands, the improvement of live stock, the conversion of much grass land into arable, the introduction and encouragement of the beetroot industry, the provision of good cottages for agricultural labourers, the system of small holdings and of agricultural education, and the improvement of the status of the departments of agriculture with power enlarged and enforced by association with existing agricultural and administrative bodies both national and local: last and not least, a basis of security and stability of the conditions, under which agriculture is to be carried out in the future, is to be the foundation of the whole structure, for without it the increase of production cannot be realized.

To secure this basis of stability the report recommends that a minimum wage for the ordinary agricultural labourer be fixed, and that a minimum price for wheat and oats be guaranteed to the farmer. Wage Boards consisting of equal numbers of representatives of the agricultural employers and labourers in given areas should, it is suggested, be appointed to report to the Agricultural Department as to the maximum weekly wage to be adopted in that area. The Departments should do everything possible to check any tendency on the part of the farmers to reduce their permanent staffs.

The lowest figure at which, in the opinion of the sub-Committee, a guaranteed minimum price would be likely to give farmers a reasonable security against loss in growing wheat is 42s. per quarter, and in growing oats 23s. per quarter. No period for the duration of this guarantee is suggested, because so long as wars are possible, it can never be compatible with national security to deprive agriculture of the stability of the price of cereals. An initiatory increase of the guarantee in the first two years after the declaration of peace is recommended, for it is believed that the impetus which this temporary additional guarantee will give to the policy of the plough will be well worth the risk of a temporary additional charge, should there be a drop in the after-war prices of cereals.

It is urged that time be given to all concerned to adjust themselves to the new conditions dictated by considerations of national safety, until the standard set before all classes interested in agriculture be attained, namely, not to be content until the whole of the soil of the United Kingdom is producing the greatest possible return of foodstuffs or of timber.

Great importance is attached by the sub-Committee to the establishment of the sugar-beet industry, and the Government is urged to arrange without further delay for a complete test of the commercial possibilities of manufacturing sugar from home-grown beet. It is hoped that the test will prove that a considerable proportion of the sugar consumed in the United Kingdom can be grown therein, and that the introduction of the beet crop into the rotation will increase the yield of other crops. In short, it is believed that the sugar-beet industry will be a contribution of much importance to the increased production of foodstuffs in the United Kingdom.

Since the above report was submitted, legislative action has been taken by the introduction into Parliament of the Corn Production Bill, which it is hoped, will ensure 82 per cent. of the food required in the United Kingdom being grown, and will result in 8,000,000 acres being added to the existing arable area.

THE MONGOOSE IN BARBADOS.

The Barbados *Official Gazette* of May 1, 1917, contains the report of a select Committee of the House of Assembly appointed to consider the question of taking measures for the extermination or reduction of the mongoose.

The date of the introduction of this animal into the island is given as 1879. The object was the destruction of rats, which caused much damage by gnawing the standing canes. It is conceded that the numbers of rat-eaten canes have been greatly diminished, but the Committee is disposed to attribute some influence towards this result to the general adoption of seedling canes with harder rinds. It should, however, be noted in this connexion, that in Jamaica, in the years succeeding 1872, when the mongoose was introduced, striking testimony was given to the great reduction of damage in that island. A pamphlet dated 1882, by Mr. (now Sir Daniel) Morris, Director of Public Gardens and Plantations, contains evidence to this effect, and mentions further, that according to a correspondent, there was already a notable diminution of damage in the Below and Above Cliff districts of Barbados, in which the mongoose had become abundant.

The Committee are however satisfied that, whatever useful influence the mongoose exerted in the past, it has so far changed its nature as to be no longer, unless under special circumstances, the enemy of the rat. This conclusion seems mainly to be based on instances of rats and mongoose living peaceably together in a cage until the latter were impelled by starvation to make a meal of the former. This evidence is open to objections. First, animals in captivity usually reveal little of their natural habits, which are exhibited only in response to the appropriate circumstances of their natural environment. Every boy who has tried to keep wild creatures knows how commonly they refuse even the most suitable food. Second, the form of check most commonly exercised on one animal by another, and the most effective form, consists not in the destruction of adults, which have means of escaping in one way or another, but in the destruction of the more or less helpless young.

Another piece of evidence adduced is the result of the examination of fifty-nine mongoose stomachs which, in one case only, contained material resembling rat remains. This is not nearly sufficient to establish a negative, nor is the necessary evidence given that the method of feeding on rats is such as to leave recognizable remains. Weasels undoubtedly feed on rabbits, but it would be a matter of considerable difficulty to establish this by *post mortem* examinations.

There is some inconsistency involved, after the conclusion that the mongoose is no longer the enemy of the rat, in the direction of attention later in the report to the fact that the driving of the rat from the open fields into the estate buildings by the mongoose has caused enormous loss by the destruction by the former of harness leather, stock feed, etc.

Whatever the real facts of the rat question may be, it is no longer, in the view of the Committee, the matter of principal concern. This is to be found in the increasing damage (held to be a menace to the future of planting in Barbados) attributed to insect pests. It is believed that the mongoose, by destroying insect-eating birds, lizards, and toads, 'has so upset the equilibrium of tropical nature in this island that the results of such disturbance have at last begun to make themselves seriously felt.'

The pests indicated as having seriously increased are the root borer, the moth borer, and the scarabee. Of the animals supposed to have controlled these pests in the past

the ground lizard is specially mentioned as having become exceedingly scarce throughout the island. The 'frog' (*Bufo marinus*, itself an introduction) is also recorded as much less plentiful than formerly. The drying up of ponds is conceded to have had an influence on this.

It would seem to be questionable whether the reduction in the numbers of birds in certain localities may not be attributed with more probability to the progressive clearing away of trees and cover, than to the effect of the mongoose, as held by the Committee, in causing the rats to live in trees and acquire a taste for the contents of birds' nests. Certainly the insectivorous birds recorded as natives of the island are plentiful enough in the suburbs of Bridgetown, in spite of the abundance of rats also to be found there. So far as the writer's observations go, the same can be said of other districts where sufficient cover obtains. If the planters are really concerned to have the co-operation of toads and birds, the provision and repair of ponds, and the display of a little tolerance for trees and bushes on waste patches of ground are direct and effective measures to this end.

That the mongoose cannot altogether be held responsible for the increased prominence of the root borer, is shown by the equal increase of attention given to this pest in islands where the animal has not been introduced. It is a general truth with regard to human observation, that 'one sees only what one knows'. Evidence which has been passed over a thousand times without notice, becomes, when once its significance is pointed out, apparent on every hand.

The conclusion reached, then, from the perusal of this report with an open mind, is that while public feeling is against the mongoose, the actual case against it is not proven. To form a reliable estimate of the results of the introduction, results that in many cases are very indirect, it would be necessary that long and careful investigations should be made by competent observers. Such an enquiry would at this time moreover be much hampered by the absence of reliable evidence as to previous conditions.

There is another aspect of the case. Given that the introduction of the mongoose has caused changes in the composition of the local fauna to the disadvantage of cultivated crops, is it the most hopeful way to try to undo those effects by reducing the numbers of the mongoose, as recommended in this report, or would it not be wiser to accept an accomplished fact and to adopt more direct means of protection against the effects complained of? Few would question that the mongoose has come to stay, or that efforts to reduce its numbers by means of bounties, if they have any visible effect at all, will, to retain that effect, need to be continued in perpetuity. And it cannot be taken for granted that even a notable reduction in the prevalence of the mongoose would lead to the restoration of previous conditions.

The methods of direct control of the insect pests indicated cannot be claimed to be complete, but if there were any disposition shown towards their adoption, they could doubtless be improved upon. As it is, they offer more prospect of relief than is to be obtained from invocations to Nature, conceived as a revengeful goddess upset in her 'equilibrium' and only to be appeased by an offering of the blood of the intruder.

A writer in a recent Trinidad journal asks a pertinent question:—If people are really suffering from the depredations of the mongoose, why don't they set about killing them? That they don't do so, he remarks, makes us doubt the sincerity of their complaint. Why should they want rewards for benefiting themselves?

W.N.

RATS AND THEIR EXTERMINATION.

With reference to the report of the select Committee of the House of Assembly appointed to consider the question of taking measures for the exterminating and reducing of the number of mongoose in Barbados, it is well to bear in mind that the reason for the introduction of the mongoose into the West Indies was to get rid of the rats which were causing serious depredations in the cane fields, to consider, if the mongoose is exterminated, what will be the results of the comparative immunity enjoyed by the rat, and to inquire more carefully into other methods for coping with these pests.

The rat is found closely but discreetly attaching himself to man through the instinct of knowing that food and water are to be found near the latter's dwelling, and man, on the other hand, recognizing the nuisance caused by the voracious appetite and thirsty nature of the rat, has responded by vain endeavours to rid himself of his unwelcome guest. The rat is obnoxious to man for many reasons, some of which have only lately become known owing to the recent advances of medical science. Rats are omnivorous, and the loss caused by their depredations is not confined to the food they eat, but extends to the food they spoil and the damage they cause by gnawing through such structures as wooden partitions in search of food and water. But the actual damage caused by rats is endurable when compared with the disease they assist in spreading throughout the world. The rat, long suspected of being concerned in the spreading of the plague or black death, is definitely found guilty by modern science of acting as the host of the plague-flea, while it has also been proved that trichinosis is also spread by this rodent. From feeding experiments with wild rats it has been found that the economic damage to food and material in Great Britain probably amounts to £15,000 000 annually. In the United States Public Health Reports of 1913, it will be seen that a stage has been reached at which, knowing the history and habit of the brown rat, we may consider the best means of coping with the pest under the following heads:—

Preventive means: (1) rat-proof construction; (2) adequate protection of water and food.

Curative means: (1) frightening; (2) destructive—(a) natural enemies, (b) traps, (c) poisons.

PREVENTIVE MEANS. Many kinds of structures formerly made of wood are now constructed with cement, and when these buildings have an efficient concrete foundation, an effectual barrier to the ingress of rats is imposed. The screening of basement windows with wire netting, the furnishing of all drain pipes with traps and gratings, and the elimination of all means by which rats can climb and obtain access to buildings must be accomplished if the cunning animal is to be baffled.

Keeping anything which may serve as food for rats in rat-proof receptacles, is one of the surest methods of discouraging their presence in buildings. The rat is known to be a very thirsty animal and cannot live long without water, and, from experiments conducted by the United States public health officials, it was found that rats in the majority of cases live only from three to fifteen days on wheat without water, but with foods containing much water such as carrots, the animals were alive thirty days after the commencement of the experiments. The necessity to rats of water or watery foods is one of the guiding principles in maintaining free from rats warehouses and other buildings containing food.

CURATIVE MEASURES. Although a rat is not easily frightened, it may be desirable to place in its runs or

burrows one of the following substances: freshly slaked lime, dry, or as a thin whitewash; a strong solution of ferrous sulphate (copperas); chloride of lime; gas-tar; powdered red-pepper; or caustic potash.

In the West Indies, except the mongoose and snakes, there are no natural enemies of the rat among the wild animals and birds.

Trapping is an effective method to reduce the number of rats, but it requires considerable knowledge to meet the cunning of the wily rat, while precautions have to be taken in the employment of poisons in their extermination. The latest form of poisoning is that of spreading disease among rats by prepared bacterial cultures. But all these methods for the destruction of these vermin will be futile unless concerted action is taken by the whole community, for the rats in one area are likely to migrate to another and so escape. Stringent measures to develop immunity, as well as to prevent fresh colonies of rats being landed by visiting vessels must also be taken.

TRADE BETWEEN CANADA AND THE WEST INDIES.

The report of the Department of Trade and Commerce of the Dominion of Canada for the fiscal year ended March 31, 1916, possesses special interest for West Indian readers, affording as it does an opportunity of seeing the results of the war and of the reciprocal trade relations entered into by Canada and the West Indies under the terms of the Preferential Tariff Agreement signed at Ottawa in 1912, which was the outcome of the Commission under the Chairmanship of Lord Balfour of Burleigh.

From the report it appears that in the period of five years ended 1916, the total Canadian exports and imports to and from the West Indies have been:—

	Value of Exports. \$	Value of Imports. \$
1912	4,034,425	5,345,861
1913	3,960,625	6,058,959
1914	4,489,869	4,484,944
1915	4,366,792	6,039,595
1916	4,134,901	6,355,785

It will thus be seen that the total trade between the Dominion and the West Indies has, during the period in question, increased from \$9,580,286 to \$10,490,686.

The chief article imported from Canada into the West Indies was wheat flour which, in 1912, was in value \$1,595,986, in 1915 \$2,340,259, and 1916 \$2,074,670.

The values of the chief articles of West Indian production imported, in 1912 and 1916, into the Dominion were:—

	1912. \$	1916. \$
Cacao	85,265	365,249
Coco-nuts	81,751	27,436
Bananas	14,495	...
Limes	1,051	107
Oranges	60,720	43,213
Shaddocks		
Grape-fruit		
Lime juice (crude only)	14,979	23,655
Rum	18,581	22,043
Sugar and molasses, duty	3,980,161	4,463,257
Sugar and molasses, free	1,080,721	999,615

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
May 31, 1917.

ARROWROOT—5d. to 6½d.
BALATA—Block, 3/0½ to 3/2; Sheet, 3/9 to 4/.
BEESWAX—No quotations.
CACAO—Trinidad, 85/- to 86/-; Grenada, 80/-; Jamaica, no quotations.
COFFEE—Jamaica, 71/6 to 88/-.
COPRA—£45 15s. to £46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £35 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, 90/- to 110/-.
ISINGLASS—No quotations.
HONEY—Jamaica, 75s. to 105s.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—1/6 to 2/3.
NUTMEGS—10½d. to 1/-.
PIMENTO—4d.
RUBBER—Para, fine hard, 3/2; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, 5/2 to 8/6.

New York.—Messrs. GILLESPIE BROS. & Co., June 15, 1917.

CACAO—Caracas, 12¾c. to 12¾c.; Grenada, 12c. to 12¼c.; Trinidad, 12c. to 12¼c.; Jamaica, 10¾c. to 11½c.; COCO-NUTS—Jamaica and Trinidad selects, \$38.00 to \$48.00; culls, \$22.00 to \$24.00.
COFFEE—Jamaica, 9¾c. to 11½c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, \$1.00; Antigua and Barbados, 90c. to \$1.00; St. Thomas and St. Kitts 85c. to 90c. per lb.
GRAPE FRUIT—Jamaica, \$1.75 to \$2.25.
LIMES—\$5.50 to \$8.00.
MACE—38c. to 42c. per lb.
NUTMEGS—20½c. to 25c.
ORANGES—\$1.25 to \$2.00.
PIMENTO—6½c. per lb.
SUGAR—Centrifugals, 96°, 5.89c; Muscovados, 89°, 5.03c.; Molasses, 89°, 4.87c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., June 22, 1917.

CACAO—Venezuelan, \$11.80; Trinidad, \$11.25 to \$11.75.
COCO-NUT OIL—\$1.12 per Imperial gallon.
COFFEE—Venezuelan, 10c. to 12c.
COPRA—No quotations.
DHAL—No quotations.
ONIONS—\$4.50 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$5.75 per 100 lb.
RICE—Yellow, \$9.50 to \$10.00; White, \$6.75 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., June 12, 1917

ARROWROOT—\$6.00 per 100 lb.
CACAO—\$12.50 per 100 lb.
COCO-NUTS—\$26.40 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$5.50 to \$6.00.
PEAS, SPLIT—\$12.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$9.50; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$4.50 to \$5.00.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	MESSRS. WIETING & RICHTER.	MESSRS. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



A FORTNIGHTLY REVIEW
OF THE
IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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The Dominions Royal Commission.

AFTER inquiries extending over five years, the Royal Commission on the natural resources, actual and potential, of the Self-Governing Dominions of the Empire, with practical proposals for their utilization, have issued their final report, which is a valuable document: indeed, as *Nature* for April 30 truly remarks, it is quite certain that no Blue Book of such momentous importance as this as to the develop-

ment of the resources of the British Empire as a whole has ever before been published.

Broad, however, as the scope of the inquiry was, it could not be kept within the limits originally prescribed. As the Commissioners state: 'For Empire purposes no survey can be complete without including India, the Crown Colonies and the Protectorates. In themselves, and even as now developed they form too vital and important a part of the Empire to be left out of present calculations. But it is plainly evident that their potentialities, measured by any fair standard, are immense, and that their future contributions to the Empire's strength and greatness will far surpass those of the past. These parts of Your Majesty's oversea possessions are vitally linked with the self-governing Dominions; the destinies of all are interwoven.' The report, therefore, deals with the problems connected with the reconstruction and development of the Empire as a whole.

Among the recommendations of the report are—the creation of an Imperial Development Board to be charged with the duty of promoting the development of the national resources, trade and communications of the Empire. To control and supervise emigration in co-operation with a consultative board including colonial representatives the creation of a Central Emigration Authority is recommended, and the question of land settlement for ex-soldiers and their families is considered. Communication between all parts of the Empire should, it is suggested, be improved by developing and deepening harbours, the provision of speedy steamship services, the controlling of freight rates and reduction of cable rates. Recommendations are made for the improvement of the commercial intelligence system in various

parts of the Empire, importance being attached to the holding of exhibitions, inter-imperial, and also of foreign goods competing with British goods in the various markets of the world, and to uniformity being secured in trade legislation. The establishment of uniform coinage based on the decimal system and uniform metric weights and measures are recommended.

It is considered vital that the Empire should be placed in a position to resist any pressure which foreign powers could exercise in time of peace or war in regard to the control of raw materials and commodities essential to its existence. As a step towards ascertaining how such independence can be secured it is urged that an immediate survey be made by the proposed Imperial Development Board into the relation between imperial production and imperial requirements, and that the result of the survey should divide the necessary materials of war and commerce into three main categories:—

(a) Materials of which the world's requirements are mainly or wholly produced within the Empire: such are nickel and asbestos produced in Canada, jute in India, and palm kernels in Africa.

(b) Materials of which imperial requirements are approximately equalled by imperial production: such are wool, cheese, butter, meat and wheat.

(c) Materials of which the world's requirements and with them those of the Empire, are mainly produced and controlled outside the Empire: these include cotton, petroleum, nitrates and potash.

Investigation in this survey should, it is pointed out, take two directions, namely, to discover the possibility of finding new sources of supply within the Empire and the possibility of finding substitutes within the Empire, and also to devise means for preventing waste in existing sources of supply of minerals, while the need for increasing the supplies of cotton is declared urgent.

Pending the result of the investigations of the Development Board the lines of action suggested in order to stimulate production are—the grant of bounties on output; Government purchase at a minimum price; restriction of foreign control; and restriction of Government purchases to articles produced from Empire materials.

With regard to the constitution of the Imperial Development Board, which is to be purely advisory in its initial stage, the Commissioners recommended the appointment of seven representatives for the United Kingdom, India, the Crown Colonies and the Protectorates, and of one each for the self-governing

Dominions, and they further suggest that the Board should carry out the research work required for the survey in the following manner:—

(a) In respect of the United Kingdom, through the recently formed Department for Scientific and Industrial Research, the National Physical Laboratory.

(b) In respect of the self-governing Dominions, through the now existing scientific departments and the Committees for research which are being set up in the Dominions.

(c) In respect of India, the Crown Colonies and the Protectorates, through the local scientific departments and the Imperial Institute.

The Commissioners conclude by saying: 'We make bold to assert after five years' experience throughout the Empire that the spirit of co-operation, so splendidly demonstrated in war, will be succeeded, after peace is declared, by absolute concord in the great task of reconstruction and development.'

In support of the recommendations of the Commission the decision of the Imperial Conference in favour of Imperial Preference is of great importance and the Conference also records its opinion that the safety of the Empire and the necessary development of its component parts require concerted action with regard to the following matters:—

(1) The production of an adequate food supply and arrangements for its transportation under any conditions that may reasonably be anticipated.

(2) The control of natural resources within the Empire, especially those that are of an essential character for necessary national purposes, whether in peace or in war.

(3) The economic utilization of such natural resources through processes of manufacture carried on within the Empire.

DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture left Barbados on July 11 for Antigua with the object of paying an official visit to that Presidency. Sir Francis Watts is expected to return to Barbados in about two weeks time.

Mr. W. Nowell, D.I.C., Mycologist on the staff of the Imperial Department of Agriculture, has returned to the Head Office after spending some days in Dominica investigating certain problems relating to plant diseases.

Dr. J. C. Hutson, B.A., Ph.D., Entomologist on the staff of the Imperial Department of Agriculture, has left Barbados with the object of paying a short visit to St. Lucia in connexion with insect pest investigations.

AGRICULTURAL PROGRESS IN PORTO RICO.

The fifth report of the Board of Commissioners of Agriculture of Porto Rico for the year ended June 30, 1916, contains much interesting reading matter and is a record, on the whole, of substantial progress in that island. Conditions have been such as to make for very high prices for sugar, with the result that there has been a great extension of the area planted in cane. This has had one bad result in that the extensive plantings have made impossible intensive cultivation methods, and it is becoming apparent that in many cases the increase in area will be offset by the decrease in yield. Intensive methods are necessary to obtain satisfactory crops from the average Porto Rican soil.

Molasses and alcohol, by-products of sugar manufacture, have shared in the prevailing high prices. As a still further by-product one firm is making a fertilizer ingredient from potash of the molasses residue left after distillation.

The outbreak of the European war temporarily destroyed the Porto Rican coffee market because of disturbed shipping conditions. While there has been partial recovery in that direction, the situation has served to make the coffee growers more anxious to secure a larger outlet for their product in the United States themselves. The Coffee Growers' Association has taken this matter up vigorously and is being assisted by the local Bureau of Information, the Department of Commerce of the Federal Government, and by various commercial agencies.

Experimental rice work is being carried on under private enterprise near Canovanas, and two crops have been harvested. It is hoped that this experiment will lead to extensive planting of what is one of the principal foods consumed by the people of Porto Rico.

Conditions in the fruit industry have not been as satisfactory as could be wished. A heavy crop in Florida and fruit rots attacking especially the pine-apple, which resulted in thousands of boxes being left to rot in the fields or packing houses, forced down prices. In consequence of these and other difficulties the fruit growers, as a whole, have shown more inclination to co-operate, a state of affairs most necessary, if the industry is to be profitable. The experiences of fruit growers in other regions, particularly California and Florida, have shown this most emphatically. Organization is necessary not only for securing better prices, purchasing materials, etc., but for the purpose of carrying out advertising campaigns and of properly taking care of problems of packing, transportation, and relations with Federal authorities.

With regard to the work of the Station, the year under review was a profitable one, progress having been made along all lines of experimental work. The exchange list of publications has increased so that at present the station library is on the mailing list of practically all agricultural stations, while the local mailing list has been practically doubled. In addition to 50 acres under canes, plantings of grape-fruit, pine-apples and vegetables have been made. A grape-fruit, mango and avocado pear nursery has been established and the best varieties of mangoes and avocado pears have been ordered.

During the time the station has been developing its own varieties of cane from seed and has sent out to the sugar estates for trial new foreign varieties—mainly seedling canes—recommended by foreign stations and tested in the experimental plots. In general, these varieties are more vigorous and healthy than the local varieties, which they also excel, as a rule, in the percentage of sugar in the juice. In the past year B.208 has caused greater interest than any other

variety. The demand for it has been greater than could be supplied. Its popularity is due to the fact that it yields a juice of higher sucrose content than other canes. Since, however, it suffers badly in case of drought, lack of fertility or poor cultivation, it will probably be a failure unless favourable conditions can be supplied. The variety D. 117 has also received some appreciation but not to the extent it deserves. It is one that does well under most conditions and might almost be considered as a general purpose cane. B. 3412, Sealy Seedling, and D.109 are other varieties which are being grown on an estate scale in the island and which deserve especial mention because they have succeeded much better than their appearance might lead one to suppose. The variety B.347 is another which is finding favour in certain localities, though not as yet grown on an extensive scale. At one of the factories a mill test was given to this variety, sixteen cars of canes being analysed. The analysis showed about 1 per cent. sucrose and 3 per cent. purity above the average of the other juice extracted during the day.

The work in plant pathology and botany continued along the lines indicated in the previous report. While, however, much was accomplished in the direction of a plant disease survey of the island, equal progress was not made in the important studies of the fungi concerned. It is expected that the work on the most pressing of these problems will be taken in hand at no distant date when additional assistance will be available. Citrus diseases have been prevalent, and in particular, fruit rots and shipping rots. Large numbers of cultures have been made in connexion with studies of these diseases, and much laboratory work remains to be done.

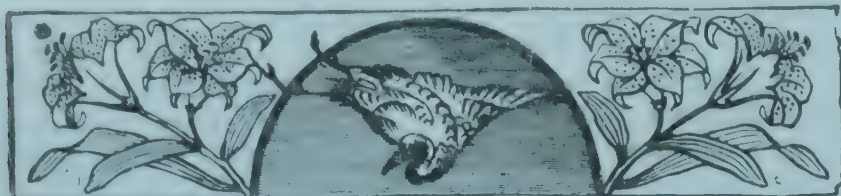
Satisfactory progress has been made in building up the station herbarium, both by addition of specimens collected in the course of the work of the department and by accessions from other sources. As heretofore, the herbarium has made possible the making of many determinations in plant disease work not only for the members of the staff but for scientists and planters who have visited the station. The library has also been materially increased chiefly through the medium of exchange with the station's publications. A number of press bulletins and field reports, mostly dealing with citrus cultures and citrus diseases, have been prepared and published in the different newspapers of the island, both in English and in Spanish.

In the entomological section the life-histories of some of the more important and destructive of the insects of Porto Rico have been worked out, so that methods of control have been considered and those applicable to the conditions of the island can be recommended. To prevent the introduction of plant diseases and destructive insects the regulations in respect of the inspection and fumigation of plants made by the quarantine service have been vigorously enforced.

From the report of the Chemist it appears that the work of the Department was conducted on the following lines:—

1. Fertilizer control.
2. Study of the acid and sugar contents of citrus fruits.
3. Analysis of seedling canes.
4. Miscellaneous tests and analyses of soil, fertilizers, insecticides, etc.

At the beginning of the shipping season for citrus fruit the question arose as to what constituted ripe fruit and the relation of artificial colouring or sweating to the acid and sugar content, and a great number of fruit analyses were made which included fruit picked at all seasons of the year and handled in various ways as to its treatment preparatory to shipping.



AGRICULTURE IN BARBADOS.

There was a marked change in the weather on the 20th instant. On that day there seems to have been an average rainfall of $1\frac{1}{2}$ inches, accompanied by several peals of thunder. Since this date there have been showers almost every day, with the result that the earth is now wet enough for tillage and planting of any land.

The rainfall for the first half of June was moderate and hardly exceeded $1\frac{1}{2}$ inches in any parish, but so favourable has been the weather since the 20th that the record for the month will exceed 5 inches in many districts and 6 inches in some.

MACHINERY.

There are still four factories and about twenty-four estates grinding, some of which will be working for at least a fortnight more. Some of the estates with canes still outstanding are those which preferred making their whole crop into syrup, having determined that this paid better than selling any part of their crop to the factories even if they were delayed by unfavourable weather or other impediments. It appears that about two-thirds of the crop of the island is now being turned out by the factories. Apart from the vacuum process, the triple effect is most advantageous and we are sure that we are not prophesying falsely when we state that there are many enterprising owners of large estates who will face the cost of improved machinery, both in the mill room and in the boiling-house, even if there is no chance of their being able to purchase canes from neighbouring estates. Co-operative factories, with the latest word in up-to-date machinery, would of course be the best system.

The factory at Haymans was long delayed in its completion, but grinding operations have been started without a hitch, and we learn that every part of the machinery is giving complete satisfaction. Next year this factory will tap an area which has to some extent been previously served by the Porter's Factory, and estates like Rock Hall, Mangrove and Black Bess will not find carriage so difficult as they have in the past.

With favourable weather, planting of vegetables will be continued until the acreage required by the Vegetable Produce Act, 1917, has been completed. The Commissioners have further communicated with landowners, stating that their proposals have been reviewed, and asking them to make a return by August 31 of the acreage of ground provisions which has been actually planted.

Indian corn has started to grow vigorously, even if irregularly, in some fields, and we have noticed that moulding is being done, either by specially drawing loose mould around each hole or by opening cane holes in process of which mould naturally falls around the clumps of young corn. A considerable acreage of this cereal has been planted in St. Lucy's parish and larger demands will be made on it. Potatoes are now 100 per cent. dearer than they were at this time last year. Such a scarcity of this vegetable has not been experienced since the severe drought of the early seventies.

During the past fortnight the price of crystals and Muscovado has remained steady at \$4.25 and \$4.50 per 100lb. respectively; Fancy Molasses has been sold at 32c. per gallon, but offers were not always made for Choice. (*Barbados Agricultural Reporter*, June 30, 1917.)



COLONIAL REPORT ON BARBADOS. FOR 1915-16

Although there was a deficit on December 31, on the year's transaction of £14,525, the Colonial revenue increased by £13,392 during a year in which the foundations of the civilized world were quivering from the effects of war. To the extent of £9,815 the increase was due to new taxation on sugar, molasses, rum, spirituous liquors and tobacco. Apart from the extra taxation therefore, the annual revenue grew to the figure of £3,577, the chief cause being the exceptionally high price of sugar which increased the spending power of the people.

Owing to war causes, principally lack of shipping facilities, higher freight rates, and to commodities reaching untempting prices, imports fell from £1,300,073 in 1914 to £1,270,154 in 1915. On the other hand, exports increased from £915,099 in 1914 to £1,181,986 in 1915, the values of the principal articles of export being,

	1914. £	1915. £
Bread and crackers	6,600	6,648
Cotton-seed meal	1,625	1,769
Raw cotton	13,473	17,042
Hides, skins	6,334	4,214
Lime, building	1,454	1,752
Oleomargarine	2,251	1,913
Vegetables, fresh	6,676	8,959
Sugar, muscovado	94,688	159,512
„ crystals	158,372	342,989
Molasses, choice	55,332	74,173
„ , fancy	306,076	204,904
„ , vacuum pan	1,158	8,526
Rum	444	2,780

The seedling sugar-cane B. 6450 continues to give excellent results as compared with the White Transparent and other varieties. The local Department of Agriculture reports that for the 1915 crop the average yield of this variety over large areas exceeded that of the White Transparent, the standard cane, on the average of both plants and ratoons in the black and red soil districts by 8.7 tons of cane per acre and, in spite of the comparatively poor quality of the juice, due to the excessive rainfall during the reaping season which prevented the canes ripening properly by over a $\frac{1}{2}$ -ton of dark crystal sugar per acre. Other new varieties, notably Ba. 6032 and B. H. 10 (12), have also given excellent results and plants are now being distributed to the estates for cultivation in considerable areas.

As regards cotton, the local Department of Agriculture has endeavoured during many years, by selection and hybridization, to obtain varieties having resistance to pests and diseases and giving satisfactory yields of good quality lint. There were manufactured in the island 185,952 gallons of rum as compared with 235,049 in 1914, a decrease of 50,097 gallons.

Of 291 sugar works in Barbados, 102 were equipped with steam machinery. There is a strong tendency towards the erection of improved machinery, but improvement in this direction has been retarded on account of increased difficulties, owing to conditions resultant on the war, in obtaining material.

A WEST INDIAN SOURCE OF TANNIN.

In view of the demand which at the present time exists for tannin material, it may be well to call attention to the value of the pods of *Acacia arabica* a tree very common in Antigua and other West Indian islands under the name of 'Cossie', or 'Cassie'.

In India, these pods are known as Babul pods, and in the Sudan by the name of Sant pods. According to the *Bulletin of the Imperial Institute*, Vol. IV (1906), p. 96, a sample received from the Sudan contained as much as 35.4 per cent. of tannin, and this tannin produced a soft light-coloured leather. It may be suggested that a larger yield of tannin would be obtained if the pods were crushed and the seeds screened or sifted away. But in India, according to the same journal [Vol. XIV, p. 614 (1916)], the tan liquor prepared from the pods speedily undergoes deterioration and is therefore not used for tanning. It appears that at high temperature, such as occurs in India and the tropics, a fermentation of an undesirable kind sets in. This fermentation is mainly due to a fungus—a species of *Mucor*—which acts upon the large amount of sugar in the pods. It can, however, be stopped by boiling the liquor, by keeping it at a low temperature or by the addition of antiseptics. An infusion of 4 oz. of pods in 20 oz. of water was found to ferment badly, but no fermentation took place within a week when carbolic acid or phenazola was added in strengths of 0.3 and 0.25 per cent. respectively, or over. An objection to the use of phenazola alone is its alkaline nature, but it has been shown that it is equally effective when slightly acidified with acetic acid, and it is recommended for use when carbolic acid is not available or is too costly. The use of antiseptics to arrest undesirable kinds of fermentation in tanning pits is, of course, well known in Europe, but a drawback to their use is that they may arrest desirable, as well as undesirable, fermentations. The experiments that have been carried out so far in India were merely with aqueous infusions of the pods and not in the presence of skins and hides, and it will be interesting to have the results of the large scale trial which, it is stated, is to be conducted in a tannery in the United Provinces.

While this material may not be very suitable as a tanning agent in the tropics because of its liability to ferment, this disadvantage is not likely to be of importance in cold climates, and it would seem that this material may be very acceptable in England at the present time. It would seem worth while, therefore, to collect it for shipment.

Advances upon Agricultural Produce.—

An Ordinance, No. 14 of 1917, repealing the Agricultural Produce Ordinance of 1906 and published in the *Trinidad Royal Gazette* of June 8, 1917, has been passed by the Legislative Council of that island to make provision for securing advances on agricultural produce. By section 4 of the Ordinance, when any land together with the crop thereon and the produce to be reaped and manufactured therefrom are mortgaged by any instrument in writing as security for the payment of money, such crop and produce upon severance from the land shall not be deemed to be personal chattels but shall for all purposes be deemed to be lawfully mortgaged and charged. It is also made lawful for the owner of any sugar factory to mortgage or charge sugars made from canes to be purchased by such owner from farmers and others. An instrument in writing may provide that the whole or any portion of the sum advanced shall be devoted to specific purposes or that the whole or any portion of the crop shall be delivered to the mortgagee or that any money received by the mortgagor in respect of the crop shall be applied in the manner specified in the instrument.

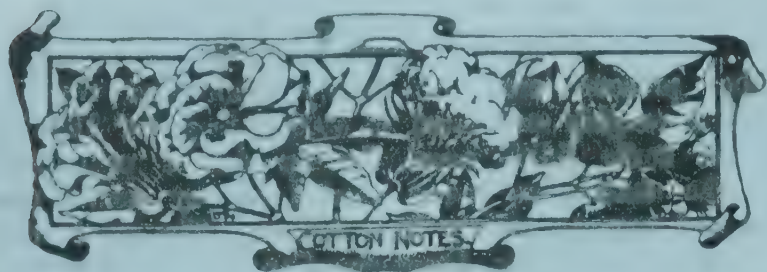
RICE IN TRINIDAD.

The present crop of paddy (unhusked rice) in Trinidad is roughly estimated at 40,000 bags (of 160 lb.) grown on some 5,000 acres. Swamp rice is principally grown, the cultivation being carried on by small proprietors and tenants, mainly East Indians. The chief areas of production are in the Oropuche, Caroni and Chaguanas districts, but small patches exist in other localities. Hill or upland rice is also cultivated on a very limited scale in many parts of the Colony. A considerable proportion of the crop is hulled in the houses of the growers in simple pounding mills, and the surplus sold to the rice mills, of which there are three at work, situated at Port-of-Spain, St. Augustine and Chaguanas. The total capacity of these mills may be stated at 100 bags of paddy per day. These mills are capable of dealing with more than double the present rice crop of the island. The yield of cleaned rice is approximately 60 per cent. of the weight of the paddy.

In a report of a special committee of the Board of Agriculture of Trinidad, which appears in the *Trinidad and Tobago Bulletin*, Vol. XVI, Part I, and which was adopted by the Board, February 21, 1917, are to be found valuable suggestions for the encouragement of the industry. It is recommended that the Department of Agriculture should continue its trials of imported rices, especially those of British Guiana, India and Louisiana varieties, but that no general distribution of the seed of such varieties be made until it has been shown that they are suited to local conditions and give better returns than those already grown. At present, there seems to be no need to recommend the establishment of co-operative mills by a direct Government subsidy, but it is suggested that steps should be taken to acquaint rice growers with the mode of working such enterprises as co-operative rice mills, which future development of the industry may render desirable, and which could readily be established through the medium of the Agricultural Credit Societies Ordinance. Measures are to be taken to ascertain the suitability of certain areas for irrigation schemes and, if such schemes prove feasible, Government assistance might be afforded by the guarantee of interest on the capital expenditure required, and this proposal is recommended not only in view of the attraction which would be afforded to East Indians to settle in the Colony but also of the urgency of increasing the local food supply.

Correlative Characters of the Rice Plant.—

From a study of rice varieties grown on the lowlands of the Philippines to determine the relative values of the most apparent characters, especially in their relation to the period required by a variety to reproduce itself and to the degree of reproduction, some of the most striking results, according to the *Experiment Station Record*, Vol. 36, No. 6, were as follows: The length of the growing period of rice, if not less than 120 and more than 180 days, has no appreciable effect on yield. Extra early maturity is to be had at the expense of yield. Late maturity is conducive to loss through disease, insects, etc. A variety that tillers freely produces more grain per acre than one that does not; but when rice is transplanted, tillering can be largely regulated by the number of plants set in the till. Tillering, the number of grains per panicle, and grain size are compensating characters. The long period of development in the rice plant permits of environmental influences not found in such plants as oats and barley. It appears that the medium characteristics, and not the extremes, result in the highest consistent yields.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland of Liverpool, write as follows, under date June 11, 1917, with reference to the sales of West Indian Sea Island cotton:—

No business has been reported in West Indian Sea Island cotton since our last report, but quotations are raised a further 1d. per lb.

Area under Cotton in Montserrat, 1916-17--

Mr. W. Robson, Curator, Botanic Station, Montserrat, has informed the Imperial Department of Agriculture that the total area under cotton in Montserrat during the season 1916-17 was 1,997 acres compared with 1,953 acres in the previous year. As there are 55 bales representing 21,020 lb. of lint yet to be shipped of last year's crop, the total output is brought up to 313,322 lb. of lint, or at the rate for the island of 156 lb. of lint per acre. The season, therefore, was the fifth best, both in total output and in the average yield of lint per acre, in the last fourteen years. Mr. Robson adds that the area planted in the present season will be considerably larger than in recent years, chiefly through the activity of small growers; the area planted by estates will probably be much about the same, chiefly as the result of labour difficulties preventing extensions in area.

Importation of Cotton Seed into the Windward Islands Prohibited.—In pursuance of the provisions of the Plant Protection Ordinance, the Governor-in-Council of the Windward Islands at Grenada has prohibited the importation directly or indirectly from any country, other than the colonies of St. Lucia and St. Vincent, of cotton seed or seed-cotton. Provision is made that seed may under special circumstances be imported under special license given by the Governor or the Superintendent of Agriculture on behalf of the Governor.

Reference to the *Agricultural News* for April 21, 1917, and May 19, 1917, will make it evident that grave danger exists that the Pink Boll worm of cotton may become introduced into these islands from North or South America if seed is allowed unrestricted entrance into the cotton-growing islands of the West Indies; and it is for this reason that prompt legislative action has been taken in the Windward Islands, as noted above.

It is understood that similar action will be taken in the Leeward Islands.

Agricultural Credit Societies, St. Vincent.

—In a recent letter the Agricultural Superintendent of St. Vincent (Mr. W. N. Sands) writes that the co-operative movement among small owners and renters in that island continues to develop. Under the Agricultural Credit Societies Ordinance twenty societies with a total membership of 753 have now been registered. Efforts are being made among the members to build two sailing vessels and to work them intercolonially on co-operative lines.

CHEMISTRY AND FOOD SUPPLIES.

The present crisis has been to indicate and emphasize the supreme importance of scientific knowledge and methods, and to enhance the value of the manifold activities of the trained chemist. The extraordinary conditions imposed by the war have only laid stress on a problem which would sooner or later have become insistent—that is, the problem of our food supply. Chemistry has already come to the aid of the agriculturist by endeavouring to supply, artificially, defects of the soil. Bacterial change of nitrogenous animal refuse into nitrates available for the delicate assimilation of the plant is a long and tedious process, and for this slow natural fertilization of the soil a more rapid artificial one may be substituted. Nitrates from Chile and sulphate of ammonia from the gas and coke industries supply the requisite nitrogen by tons. Phosphates, another necessity to the plant, are supplied as basic slag, bone-meal and super-phosphates. Chemistry has already done this much for our food supply; but, as is pertinently asked in the May number of *Chamber's Journal*.—what of the future? Nitrates from South America are now approaching exhaustion; ammonia will become scarcer and scarcer as our coal supplies give out. And yet the cry will be all the time for more food! We have around us in the air an inexhaustible stock of nitrogen, but in an unavailable form. The problem of how to make it available is being even now attacked, and, to some extent, solved. Nitrolim, *Kalkstickstoff*, and other fertilizers are being made from the air. By passing air through a whirling electric arc, a portion, never exceeding however, a small percentage, burns, forming nitric acid, which may be utilized either for explosives or for agricultural purposes. The process is coming into use wherever water-power is cheap and electricity may be generated at low cost. Norway in particular, is developing this process, which, although wasteful, has a very bright future. Once given a method by which all the nitrogen of the air may be fixed in an economical manner, the food supply of the world need cause us little worry. Intensive modes of cultivation will become general. One acre will yield the produce of 2 or 3 as things are now. Completely synthetic plantfoods are an industrial possibility. Synthetic animal foods will not be far distant. Calves' milk artificially made was exhibited at the last Royal Agricultural Show and found favour. The future of chemistry is bound up in synthesis. When we can reproduce in our laboratories the infinite complexity of nature's products, chemistry will have achieved its aim.

VITAMINES IN BREAD.

Attention is called in the *Experiment Station Record* of the United States Department of Agriculture to the outcome of investigations into the cause of pellagra in South Carolina which indicate the changes of corn and wheat flours resulting from the introduction of the roller process, especially the loss of vitamins. Vitamins as explained in the *Agricultural News*, Vol. XV, p. 121, are complex substances of indefinitely known composition which in minute quantities regulate the processes of life. These investigations showed that, while the corn meal and wheat flour made by the old-fashioned process of grinding the whole grain contained practically all the vitamins of the whole grain, the highly milled products were deficient in these substances. It was also found that fowls will live in perfect health for many months on an exclusive diet of wheat, corn or so-called water-ground corn meal, whereas those fed on highly milled products die within a short time of polyneuritis, a disease similar to beri-beri.

As it is impossible to determine the vitamine content of cereal products by isolation of these substances from the natural foods, the use of the total phosphorus content as a fairly accurate index of the relative amounts of vitamins present is suggested.

Attention is called to the use of baking soda in the preparation of bread involved in the reduction of the vitamine content of bread, especially corn bread. If, however, sour milk or tartaric acid is combined with the baking soda to neutralize its alkalinity, the use of baking soda is deemed harmless. It is also stated that, while the use of baking soda without sour milk will not always prove injurious, bread so made is undoubtedly deficient in vitamins, and, when the other dietary components are also deficient in vitamins the composition of bread made with baking soda without the use of sour milk accentuates this deficiency and may lead to impairment of health.

Summarized, the factors stated as playing a part in the reduction of the vitamine content of the people in South Carolina are—the decrease in the consumption of the more expensive foods such as meat, eggs and milk which are rich in vitamins and efficient in the prevention and treatment of pellagra; the increase in the consumption of highly milled corn meal and wheat flour; and the use of baking soda in the preparation of bread and its addition to beans and other foods to soften them and shorten the time of cooking.

A study of the dietary conditions of certain communities showed that a large proportion of the people, especially in mill villages, live on a diet which is deficient in vitamine content, wheat biscuits made from highly milled wheat flour and corn bread made with baking soda without the addition of butter-milk, are the staple articles of diet among the people, and families are to be found in which these foods represented about three-fourths of the entire diet. The fact that the above-mentioned influences, which have undoubtedly reduced the vitamine content of the diet, made themselves felt a relatively short time before the rapid increase in the pellagra incidence in these districts, furnishes considerable evidence in favour of the vitamine deficiency theory of pellagra.

GOAT'S MILK.

In view of the increased attention to the advantages of keeping goats in the West Indies and of the importation of different breeds for milk, an article which appears in the *Veterinary Record* of May 19, 1917, will be of considerable interest to those who have to do with goats. In Barbados, especially, there has been marked improvement owing to the importation of thoroughbred stock of the Toggenburg and other superior strains, and it may be remembered that owing to the high infant mortality of the peasants, five male goats, presented to the Department of Agriculture in Barbados were in 1916 stationed about the island for the purpose of improving the breed of the common goats.

Less than twenty-five years ago, Professor Nocard, it is stated in the article mentioned, in speaking of the 130,000 goats and kids which at that time were brought into Paris every spring for slaughter in the shambles at La Vilette, said that amongst all these animals the meat inspectors had never found a single case of tuberculosis. In that statement lies the essence of the argument in favour of goat's milk as a substitute for cow's milk. Despite all the efforts of legislators, the danger of infection through the milk of diseased cows still exists, but goats, if not actually immune, are very refractory to the attacks of the tubercle bacillus. In spite of its manifold advantages, goat's milk has never become popular in these islands, although in many other countries it is a common

article of diet, and in some parts of France and Switzerland the goat often takes the place of the wet nurse, to the satisfaction of all concerned. In the memoirs of Madame Hérítte-Viardot, niece of Manuel Garcia, the inventor of the laryngoscope, we find the author recording her indebtedness to a couple of goats which furnished milk for her little son during a voyage from England to the Cape, which in those days (1863) was no light undertaking, particularly for an infant.

At least two societies—the National Goat Club and the British Goat Society—have been formed for the purpose of making the milk of 'the poor man's cow' better known throughout the British Isles. Goat's milk is not only superior to cow's, but is an excellent substitute for human milk, and there is no reason why the average labourer should not possess a goat which would supply his family with pure whole milk, such as it might be impossible for him to buy in many country places, even if he had the money. Once the initial expense of purchases has been met, a goat, when circumstances are favourable, may cost very little to keep, as a considerable part of its food may consist of garden waste or of what the animal itself may find in its browsings along the roadside and hedges. Many goats thrive well when stall-fed, and the animal can be kept in health if it has a clean, dry, and well ventilated shed to serve as a stable, and a small yard or enclosure in which it can take occasional exercise. The milk is believed to be more easily digested than cow's milk, the curd being more soluble and the fat in finer emulsion. The goat will not touch dirty food and is far cleaner in its person and habits than a cow: its milk need not be boiled or pasteurized unless it has to be kept in hot weather. The late Dr. Vivian Poore took a great interest in the use of goat's milk, and for some years before his death most of the milk consumed in his house at Andover was obtained from a few goats. To the objection that the milk often had a disagreeable flavour, he replied that this could be completely obviated if the he-goat was not allowed to run with the nannies during the time they were in milk.

In some varieties of wild goats the percentage of fat may be as high as 4.8 on the average, with an extreme upward limit of 8.7. The normal is given in recent tables as 4.3 in the German breed and 3.1 in the Alpine. Crepin is of opinion—and Lesage, from his experience in Paris, appears to agree with him—that the objection which has been raised to goat's milk that it is too rich, does not apply to stall-fed goats.

Lesage concludes that the advantages of goat's milk are—(1) that the goat eats about one-sixth of the quantity of food required by a milch cow; (2) that for nine or ten months it yields 3 to 5 litres of milk, which can be taken uncooked; (3) that goats are very seldom affected by tuberculosis, since of 3,000 killed at the Lyons slaughterhouse only five were tuberculous; and (4) that the fat being in very fine emulsion is easily digested. There is a further advantage—if the animal is kept by the consumer himself, the necessity for manipulating the milk in various ways, for storing it and sending it long distances by train, as happens commonly with cow's milk is obviated. On the other side of the account must be put the liability of the goat to carry the infection of undulant fever (Mediterranean fever). In Great Britain this risk is small and, save in very exceptional circumstances, may be neglected.

The period of gestation in the goat is said to be about five months (150 days), and the average period in milk about nine months. In Europe the daily yield may be expected to be about 3 pints; 5 pints is considered to be a high yield. The small yield of British goats is attributed to degeneration of the stock due to excessive inbreeding.

EDITORIAL

HEAD OFFICE

**NOTICES.**

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

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NOTES AND COMMENTS.**Contents of Present Issue.**

The editorial in the present issue deals with the report of the Royal Commission on developing the national resources of the self-governing Dominions and Crown Colonies of the British Empire.

On page 219 will be found an interesting article describing the ways in which bees are of importance in tropical agriculture.

Two instructive articles dealing with the pruning of fruit trees and the characteristics of different kinds of clouds appear on page 221.

On page 222 will be found an important article describing the action taken by the United States in regard to agricultural development in that country in connexion with the war.

Sugar Prices.

In a letter reproduced in the *West India Committee Circular* of May 31, 1917, from the Royal Commission on the sugar supply to the Committee of West Indian Brokers, it is stated that in order to simplify the scale of prescribed wholesale selling prices of sugar, the Commission has decided to reduce the number of categories to the following five, viz: (a) cubes, chips, &c., crystals, granulated; (b) dry white sugar, West Indian grocery crystallized, yellow crystals; (c) West Indian muscovado raw sugar; (d) moist (pieces), West Indian grocery syrups; (e) jellies, knots and lumps to be sold only to manufacturers. The Committee is requested to adopt in future the same terms as those on which Commission's sugars are sold, viz: $1\frac{3}{4}$ per cent. discount, fourteen days rent and interest, in place of the usual terms of 1 per cent. discount and one month's rent and interest.

British Sugar Technologists.

The formation of the Empire Sugar Supply (Technical) Committee of the London section of the Society of Chemical Industry has, according to the *West India Committee Circular*, of May 31, 1917, been completed. The exact terms of reference of the Committee are:—

(1) To prepare an account of the pre-war sugar position as regards (a) production, its amount and nature; (b) consumption, its amount and nature; and (c) the quantity, nature, and source of the sugar imported or exported of each unit of the British Empire.

(2) To ascertain the economic sugar-producing possibilities of the British Empire.

(3) To report on the most likely localities for increased supply as well as on the kinds of sugar required by the various consumers throughout the Empire.

(4) To make such technical suggestions as may appear of use to the development of the industry.

At a meeting of the Committee held on May 23, 1917, Messrs. Ling, Macdonald and Scard were appointed an Executive Committee in connexion with the work of the Committee.

The Turks Islands Agricultural Society.

An Agricultural Society, as it appears in the *Journal of the Jamaica Agricultural Society* of April 1917, was formed in the Turks and Caicos Islands on November 21, 1916, and at the first meeting the names of 110 persons who had expressed their intention of joining the Society, were read. The Legislative Board has voted £25 as a grant to the Society for 1917, and, on the occasion of his recent visit to the Dependency, the Governor of Jamaica expressed a cordial interest in the Society and recommended early affiliation with the Jamaica Agricultural Society from which, by suggestions and advice as well as by more material assistance, the local branch might expect to be benefited. The Society procured, early in the year, seeds of easily grown annuals which were supplied to members as the

initiative for a flower show which took place at Grand Turk on May 14, 1917, and was formally opened by the Commissioner. His Honour pronounced the show, as a first attempt, an unqualified success, and alluding especially to the exhibits of seed-cotton and ginned cotton, which were one of the features of the exhibition, was most emphatic in forecasting prosperity to the Dependency from that industry.

Scientific and Industrial Research.

In continuation of references that have been made in this Journal to the report of the Privy Council for Scientific and Industrial Research for 1915-16, it may be noted that, in the *Proceedings of the Institute of Chemistry* the fact is called attention to that the British Government has decided to establish a separate Department of Scientific and Industrial Research, and to place a large sum of money at its disposal to be used as a fund for the conduct of research for the benefit of national industry on a co-operative basis. In order to encourage firms interested in various trades to make generous contributions, the Treasury have agreed that any money given for research on specified terms shall be regarded as working expenses and will thus be free from income tax and excess profits tax.

With a view to promoting this co-operative movement industrial associations will be formed in connexion with various trades for the promotion of research, and they will work under the supervision of the new central authority.

The Lyons (International) Fair, 1917.

Among the British exhibits at the Lyons Fair, 1917, the colonial produce displayed at the stand of the Permanent Exhibition Committee of Trinidad attracted, as may be gathered from the remarks of H.M. Consul General at Lyons which are reproduced in *The Board of Trade Journal* of April 26, considerable attention and numerous inquiries from would-be buyers. A report by M. Lafreyre, who was in charge of the exhibits from Trinidad, which appears in the *Port-of-Spain Gazette*, contains the following extracts which are of special interest to West Indian producers:—

CACAO. The buyers, French and Swiss chocolate manufacturers, found this article to their satisfaction. The beans are fine and healthy, and they are of opinion that the returns would be perfect and give excellent results. There would be large buyers if the merchandise could reach them at once; most of the chocolate factories have no West Indian cacao.

SUGAR. The sugar, although rather yellowish, would certainly have numerous buyers. Several usines would take as much as could be sent to them and at a very high price, but in these times, it might be requisitioned by the Chamber of Commerce.

COCO-NUTS. Coco-nuts are in demand by the Marseilles industries, especially the copra, which is used for the manufacture of oil, butter and soap.

Suspension of the 'Kew Bulletin'.

In the *Times* of May 29, 1917, it is announced that the publication of the *Kew Bulletin*, to the national and imperial importance of which emphatic testimony has repeatedly been borne in that organ, is, under pressure of war economy and the dearth of printing materials, to be suspended. Strong protests have been made from all quarters against the suspension of a Journal which not only serves as the official publication in which the results of the scientific activity at Kew are given to the world, but also serves the important function of placing at the disposal of the economic and scientific gardens in India and the Colonies the latest facts in pure and economic botany that may be of importance to them. In enemy countries, as a correspondent of the *Times* points out, the starvation of intellectual activities is not accounted to be any part even of war economy. The German publications corresponding to the *Kew Bulletin* continue regularly to appear and even to receive reports from colonies which are no longer German. It is difficult to believe, remarks *Nature* in its issue of May 24, 1917, that either the India Office or the Colonial Office, which are both concerned with the functions that only Kew is in a position effectively to discharge, can have been consulted in the matter, or, if they had been so consulted, that they could have approved of a step so unsound alike on economic and financial grounds.

Swine Fever and Serum Treatment.

In dealing with the procedure to be followed in cases of swine fever, the Assistant Secretary of the Board of Agriculture in England had explained that although the introduction of anti-swine fever treatment had rendered the slaughter of swine ailing from the fever undesirable where the treatment was accepted by the pig owner, since in order to secure the best results from the treatment such swine should be kept alive and mixed into the treated swine, yet it was not desirable at the time to cancel the arrangements for the slaughter until it was ascertained to what extent the new treatment would be taken up by pig owners. Six months experience of the new procedure provided evidence that pig owners were responding well to the offer of serum treatment, inasmuch as in almost 75 per cent. of the cases in which treatment was applicable, the owner agreed to its application, and it was therefore decided that, as from June 25, 1916, slaughter in suspected outbreaks of swine fever should be limited to such slaughter as was essential for the purpose of arriving at a definite diagnosis. Serum treatment is, as is stated in the *Annual Report* for 1916 of proceedings under the Diseases of Animals Acts, now applied under conditions calculated to secure the best results, and if pig owners are not prepared to avail themselves of the benefits to be derived from the treatment, they cannot reasonably expect any further public protection against avoidable loss arising from deaths among their swine.



INSECT NOTES.

WHITE GRUBS INJURING SUGAR-CANE IN PORTO RICO.

In the *Journal of the Department of Agriculture of Porto Rico*, Vol. I, No. 2, Mr. Eugene G. Smyth, Acting Entomologist of the Insular Experiment Station, gives an account of some of the observations that have been made by him during the past four years in studying the life-histories of the species of white grubs injurious to the sugar-cane in Porto Rico. Mr. Smyth has during this period studied the life-histories of ten species of white grubs, five belonging to the tribe Melolonthini, and five belonging to the tribe Dynastini, of the family Scarabaeidae, to which the white grubs belong. In this paper the five species of Melolonthids are dealt with, while the results of the work on the remaining five species of Dynastids are promised in a later paper.

Sugar-cane is grown over large areas in Porto Rico under conditions favourable for the rapid development of these insects, and is grown continuously year after year on the same ground without rotation of crops, so that the control of these pests is a difficult problem.

The experiments carried out in Porto Rico prior to 1913, when the present investigations were begun, consisted mainly in the introduction of poison baits and fumigants into the soil, the use of deterrents on the soil near plants to prevent egg-laying, the flooding of the land with water and the destruction of the adult beetles by spraying the leaves with poisons. Many of these measures failed to give satisfactory results, and those that seemed worthy of a further trial have since turned out to be impracticable by reason of the high cost of materials or of application. Mr. Smyth goes on to say that 'it became increasingly apparent that no hope of solution of a problem could come from an application of direct methods of control such as these, but that real benefit to the cane-growing industry could come only through the employment of broadly outlined cultural methods of control, based upon an accurate knowledge of the insects' life-histories, or perhaps through the introduction of insect or fungus parasites to prey upon the white grubs.'

Outside of Europe, until quite recently very little was known about the length of the life-cycle of any of the species of Melolonthid beetles. In 1912 Mr. d'Emmerez de Charmoy published a report on *Phytalus smithi* in Mauritius, establishing the maximum and minimum number of days required for each of the three stages—egg, larval, and pupal—in the life-cycle of this species, but not determining the length of the separate instars in the larval stage of the grub.

In 1916 Mr. J. J. Davis published an article in the *Journal of Economic Entomology*, Vol. IX, No. 2, giving the results of some experiments in rearing *Lachnosterna* at Lafayette, Indiana. Mr. Davis succeeded in determining the life-cycles of eighteen species of beetles of the genus *Lachnosterna*, and found that of the eighteen species, eleven have an invariable life-cycle of three years, one invariably has a life-cycle of two years, three have a life-cycle varying from two to three years, and in the case of two others the life-cycle varies from three to four years. It will be noticed that in a temperature having a cold winter like Indiana, the life-

cycles of these beetles is never less than two years, and is generally much longer.

As a result of his studies during the past four years, Mr. Smyth has established the fact that all four Porto Rican species of *Lachnosterna* as well as the single species of *Phytalus*, have a life-cycle of one year or less, and at the same time he has determined accurately the lengths of the instars of the grub. It may be mentioned that an instar is the period between moults; for instance, the time elapsing between the hatching of the egg and the first moult is the first instar.

Mr. Smyth has found that the four species of *Lachnosterna* (or *Phyllophaga*) are all new to Science, as well as the single species of *Phytalus*. They are being described by him under the names *Phyllophaga vandinei*, *P. portoricensis*, *P. guanicana*, *P. citri*, and *Phytalus insularis*.

Of these species *P. vandinei* is the worst pest of sugar-cane in Porto Rico. Some idea of the serious nature of this pest may be gathered from the fact that on one sugar estate 4,723,000, and 4,087,000 grubs were collected over a period of two years. Allowing 400 beetles to the quart and 300 grubs to the quart, these figures represent 369 bushels of beetles and 426 bushels of grubs; the total cost of collection was \$6,154.37. In spite of these measures this pest is not being controlled, but continues to increase. This species is fortunately confined to a definite area equivalent to about one-third of the area of the island.

Mr. Smyth gives an account of the methods of rearing white grubs, and data on the habits and life-history of *Phyllophaga vandinei* which are of great interest. Most of the work in connexion with white grubs has been done with this species, so that more is known about it than about any of the other white grubs injurious to sugar-cane in Porto Rico.

METHODS OF REARING WHITE GRUBS.

At first there was some difficulty in determining the possible duration of the egg-laying period of adult female beetles, since beetles confined in numbers in a cage or jar with potted plants suffered a heavy mortality, possibly due to a fungus disease. Later it was found that beetles could live fairly normally in confinement without the necessity of flying or climbing. Beetles were collected after mating, and each female was confined singly in a small battery jar with some finely sifted moistened earth at the bottom and a piece of banana leaf previously dipped in water. The leaf was put in above the soil and served for food for two or three days. After various experiments in rearing eggs the simplest method was to place the eggs over damp soil in shallow glass petri dishes, care being taken to keep these in a situation of little exposure and of uniform temperature, and to see that the soil be sterile, so as to prevent attacks by mites and nematodes, to which the eggs are very susceptible.

As soon as the grubs hatched they were placed in small, round tin boxes containing sifted, moistened soil. The grubs were put in small pits made in the soil, as it was found that if placed on the surface they are often unable to penetrate. The young grubs seem to feed almost entirely on the organic matter in the soil until near the first moult. Food was then supplied in the shape of a grain of corn to each box, and a new grain was not put in until the old one had been entirely eaten, germinating roots and all. An excess of food in a box invariably encouraged mites, which attacked the grub sometimes killing it, unless they were brushed off in time and fresh earth supplied. The use of these tin boxes was found to be more convenient than larger cages, such as flower pots or battery jars, since the grubs could be more easily exposed to observation without disturbing them too much. Towards the end of the third instar the full-grown grub becomes soft and flabby and lies inert on its back at the bottom of the

cell, which it has previously formed from part of its tunnel. It then changes into the pupa and later to the adult. It was found that while the grubs were in the active larval stages they were often able to resist diseases or attacks by mites, but during the quiescent prepupal and pupal stages they succumbed, either to injury, or to the attacks of mites or of the bacterial disease, *Micrococcus nigrofaciens*. Many hundreds of eggs were hatched out, but the grubs obtained from them gradually died off in the different stages before issuing as adults, with the result that only about twenty beetles of *P. vandinei* eventually emerged.

Check experiments for each species were carried on in large outdoor rearing cages with earth in which cane or corn was grown as food. A number of adults were liberated in them, one species in each cage, about the same time that the indoor experiments were started. The adults were removed about a week later, eggs having been deposited meanwhile in the soil. The cages were left undisturbed, except for occasional attention as to food and moisture, until the grubs passed through their various stages and the adult beetles emerged. It was found that the adults from grubs in these outdoor cages emerged at the same time as the adults from grubs in the tin boxes, provided that a grub escaped the attacks of mites, fungus or bacterial disease. In the case of the species *Phytalus insularis*, no larvae reared in tin boxes reached maturity, so that the length of the life-cycle had to be determined from the results obtained in the outdoor cages.

In the next issue details will be given about the life-cycle of *Phyllophaga vandinei*, and mention will be made of the natural enemies of white grubs in Porto Rico

J.C.H.

BEES IN RELATION TO AGRICULTURE.

In a report giving an account of a recent visit to the coco-nut districts of the colony, the Government Entomologist of Fiji noticed that, on those estates where bees were kept, the bees swarmed around the open efflorescences in great numbers, and that the yield on those estates was exceptionally high. As trees of five or six years bore heavy crops and the bunches were well filled, it is recommended in the report that a general introduction of bees on coco-nut estates would be well worth a trial. Similar observations have been made in regard to lime plantations.

Sufficient importance is not paid to the part played by insects in the fertilization of plants, and the usefulness of the bee is but scantily recognized by planters in the West Indies. The bee is one of Nature's silent workers, and this, perhaps, is the reason why the benefits derived from their work is not appreciated at their full value. Some years ago, a bee expert, at the instance of the Imperial Department of Agriculture, visited several of the West Indian islands to stimulate interest in bee-keeping, but, although some persons were induced to establish hives for the production of honey and wax, the fact that the bee's most important work is that of the fertilization of plants was practically overlooked, and it may therefore be of practical benefit to discuss briefly the process of that work.

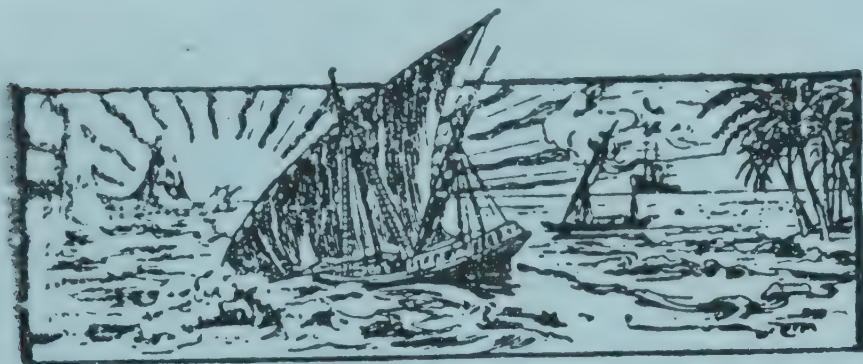
The object of plants blossoming is, as is well known, to produce perfect seed and to perpetuate the race. More than 200 years ago, it was discovered that, to produce seed, pollen must be placed on the stigma, the female part of the plant. Although most flowers possess both anthers, the male part, and stigmas, and have thus the two sexes within themselves, which would lead us to suppose that

such a form of flower would insure the transmission of the pollen to the stigma so that the object of its blossoming might be accomplished, it has been found that the protest made by Nature against inbreeding applies no less to plants than to animals. It is now established that the structure of conspicuous flowers, generally speaking, is such as to prevent, or at least to impede, fertilization by their own pollen, for it has been discovered that the male flowers and female flowers on the same spadix do not mature at the same time. As pointed out in a recent number of the *Journal of the Jamaica Agricultural Society*, the males open soon after the spathe or covering bursts, and the pistillate at a later period. As a rule, too, one set of flowers opens or is ready to fertilize or to be fertilized at a period not coincident with the opening of the other set. This is one of Nature's devices calculated to guard against inbreeding or self-fertilization, and insures that fertilization from another coco-nut must take place.

The question naturally arises how the fertilizing dust is carried from one flower to another, but Nature, in this matter also, has provided curious arrangements to secure to a plant the pollen from some other plant or flower of the same species. For some plants the work is done by the wind wafting pollen from one plant to be caught by another on the branched and hairy stigmas which grasp it as it travels past. But, just as one of the most striking advances in our knowledge of the mode of causation of disease is our recognition of the important part taken by many insects in giving rise to various maladies, we have also been taught by the carefully conducted observations of Darwin and other naturalists, that the fertilization of many plants can only be accomplished if certain definite insects are present which can carry the pollen from one plant to another, and that if an attempt is made to grow those plants in a district where those special insects are not to be found, the plants, though they may grow in great luxuriance, can never set their seeds. An instance of this is to be seen in the case of the vanilla plant. Amongst insects, bees are of the greatest utility in fertilization. As the visits of these insects are necessary to the existence of the plants, the flowers, by their attractive dress and sweet perfume secure these visits. The blossoms themselves, it is true, require pollen, but the quantity produced is much greater than what is required for blossom fertilization. The excess is the food of the bee, while nectar from which honey is derived is principally produced as a reward for its services. In this way, insects and flowers are mutually dependent on each other for existence.

A colony at full strength consists of three kinds of bees: one queen or mother, forty to fifty thousand workers, and several hundred drones. The queen is the mother of every bee in the hive and does no work but that of reproduction, while the drones are the males, their only use being the perpetuation of the species. The worker is the only one to collect honey, her tongue, which is long to enable her to reach to the bottom of the flower, being provided at the tip with a brush for the collection of tiny particles of pollen. The body, especially the underside, is covered with feathery hairs, to which the pollen grains adhere and which thus become the medium for conveying pollen from one plant to another. The hind-legs have also a pollen basket in which the surplus pollen is carried to the hive, where it is stored and eventually used for food.

Apart from apiculture being a fascinating study, the keeping of bees may be of direct advantage in the production of honey and wax, and of less apparent, but equal, profit in increasing the yield of fruit and other crops by the aid given to fertilization.



GLEANINGS.

By a Proclamation published in the *Leeward Islands Gazette* for May 16, 1917, the benefits of the Preferential Tariff accorded to the Dominion of Canada are extended to goods imported into the Presidency of Antigua from Barbados.

In *Bulletin No. 330* of the United States it is stated that winnowed rice is covered with hard siliceous hull. The hulled grain is covered with a light-brown bran coating which consists of seven layers. During the process of milling six of these layers and a portion of the seventh are removed.

The cacao industry in the Gold Coast continues to enjoy great prosperity according to the *West India Committee Circular*, of May 31, 1917, for the exports of last year which are valued at £3,840,567 seem likely to be exceeded. In the first two months of the present year cacao valued at £934,018 were shipped.

The Government Cotton Ginnery of St. Vincent is offering in the *St. Vincent Gazette*, for sale at 5c. per lb., selected and disinfected cotton seed of excellent germination. The cotton from which the seed was obtained was specially bred up from a single plant by the Agricultural Department. It is of good, 'ordinary grade', very even and fine.

The Philippine Islands exported 338,000 tons of sugar in 1916, while in 1915 and 1914 the quantities exported were 208,000 and 235,000 tons, respectively. The exports to the United States in the past year ran to 137,000, while in 1915, as appears from the *Louisiana Planter* of April 14, 1917, it was only 87,000 tons.

Continued attention is being given by scientists to the question of the rôle played by vitamins, the infinitesimal something in natural food which appears to be essential to satisfactory food assimilation. A recent number of *Comptes Rendus* of the Bacteriological Society contains the results of experiments on feeding, which are of great importance.

It is gratifying, writes the *Field* of May 26, 1917, to perceive the increased recognition of indebtedness for the rapid completion of spring work to the assistance rendered by oil tractors. The steam and oil tractors have quickly won their way into favour, sheer necessity having gained for them opportunities and prominence that otherwise it might have taken years to win.

According to the *Agricultural News* of Durban, of February 15, 1917, more than 20,000 acres of good and fertile land in Queensland are infested with the prickly pear, which, however, might be utilized in connexion with the manufacture of potash. It is stated that the ashes from 5 acres of burnt prickly pear contained $\frac{1}{2}$ -ton of 80 per cent. potassium carbonate per acre.

A Bill was introduced, it is reported in the *Sentry* of June 15, 1917, in the Legislative Council of St. Vincent on June 11, 1917, to authorize under the provisions of Ordinance 5 of 1916, additional duties on the following products: Sea Island seed-cotton, 2d. per cwt.; Marie Galante seed-cotton, 1½d. per cwt.; Sea Island cotton 2s. per cwt.; Marie Galante, 1s. per cwt.; arrowroot, 4d. per cwt.; sugar, 3s. 6d. per cwt.; molasses, 1s. 6d. per cwt.; syrup, 1s. 6d. per cwt.

Experiments have been made in Denmark with the substitution of cacao-cake for ground nuts and soya as the food for cows. The general result, according to the *Monthly Bulletin*, has been that less milk is afforded. The cause of this is attributed to poisoning with theobromine, of which the cake used contained 1.5 per cent. Cases of poisoning had been recorded with cattle, fowls and pigs after the use of cacao-cake, and, on account of these, Professor Hawsen experimented with fowls, rabbits and mice, and came to the above conclusion.

The correspondent of the *West India Committee Circular* in the Turks and Caicos Islands writes on March 30 that over 11,000 lb. of raw cotton, as stated in the *West India Committee Circular* of May 16, 1917, were received by the Government of Turks Islands from the Caicos Islands during February and March. The industry has now passed the experimental stage, and it is hoped that in a year or two cotton will take a prominent place among the exports of the Dependency.

The value of imports of cotton manufacture into India for the year 1915-16 was £29,000,000, four millions less than in the previous year, the share of the United Kingdom in this trade being over 91 per cent. The trade is naturally influenced to a large degree by conditions of the Lancashire market, the shortage in transport and high freights, together with other increased charges in the cost of production, resulting, as is stated by the *Chamber of Commerce Journal*, in prices for manufactures being much dearer than in normal times.

In reviewing the report of the Department of Science and Agriculture in British Guiana, the *Louisiana Planter* of April 28, 1917, observes that while careful intensive experimentation has been going on for years in British territories in the Far East, we are inclined to look for the highest degree of progress, particularly in the cane industry, in the reports that come from the West Indies, and in these British Guiana stands prominent in our opinion, based upon the fact that two of the best seedling canes that are now popular in Louisiana came from British Guiana, viz. D.74 and D.95.

In a reply to a despatch from the Governor of Barbados with reference to the importation of cane syrup into the United Kingdom the Secretary of State writes, as appears in the *Barbados Official Gazette* of June 21, 1917, that the admission of cane syrup into the United Kingdom was referred to the Minister of Food from whom an answer was received explaining that the supply of sugar to the United Kingdom was limited not by a shortage of sugar but by a shortage of tonnage, and that cane syrup from the point of view both of the tonnage required and of the nutriment involved compared unfavourably with sugar.

PRUNING.

Pruning, according to *Bulletin 248 of the Ontario Department of Agriculture*, is primarily a special operation performed on the tree regularly or irregularly to make it produce fruit abundantly, by modifying the growth of the tree in reducing the amount of branches and leaves and in giving the tree a more regular form in order to obtain a higher yield. First of all, therefore, the removal of all useless branches is necessary, and then it has to be considered whether, by reducing the number of branches, those remaining will be so strengthened as to produce more fruit than if all the branches were allowed to grow. On the latter point opinions vary and, in fact, pruning, though one of the oldest of horticultural practices, has received but little scientific attention, so that definite rules cannot be laid down. The planter must investigate and ascertain for himself whether pruning increases the bearing power to an appreciable extent. The suggestions offered by Dr. van Hall in his work on cacao are valuable. After the removal of weak and diseased twigs, he advises regular treatment, once a year or if possible twice a year, always in the dry season when the tree is resting, when the wound dries quickly and parasites do not penetrate easily. A more regular reaction follows at this season than at other times when all the buds in the neighbourhood are ready to develop at once as soon as a twig has been cut. The *cleaning* of the tree by cutting away the suckers and diseased twigs needs care but no special skill, but trained pruners should be employed in the dry season to look after the clean trees and to remove superfluous twigs when the foliage system is considered too dense. In cleaning, the dead and diseased twigs and branches, as well as the water-shoots, must be cut quite close to the branch or stem to which they are attached so as to leave no stump. Both cleaners and pruners must, also, carefully cover the wounds with coal-tar in order to close them against parasites such as fungi and borers.

There is a common belief in the West Indies that, should a tree like the cacao be pruned, say three days after the new moon, for every twig cut the upward circulation of the sap will cause many more to appear, whereas if the tree be pruned after the full moon or when the sap is ascending no shoots, or very few, will be seen to appear after the operation. How much truth underlies this belief has never been scientifically ascertained.

In respect of orange trees, the general principle of pruning is to remove growth to such a degree as to allow anyone standing at the bottom of the tree to see the sky through the branches. The leaves, which are the greatest chemists in the world, cannot perform their work except under the direct influence of the sunlight and develop into growths for the extension of the tree or into blossoms furnished with protective and essential organs for producing fruit.

In Pamphlet No. 72 of the Imperial Department of Agriculture it is stated that limes for the most part require but little pruning. Dead wood should be promptly removed and suckers kept trimmed to such a number that they will not choke out the main growth of the tree. From the habit of growth of the lime it will be seen that it is natural for a few suckers to be continuously developed and these take the place of the older branches which die from one cause or another. In fact, it is often necessary to develop one or more suckers when the top of the tree has suffered an injury in order to preserve the tree and save the time that would be lost if a new tree had to be grown from the seed supplied.

CLOUDS.

Among the readily accessible means at hand for ascertaining the approach of hurricanes, provided intelligent use is made of ordinary powers of observation, clouds are so invaluable in affording information as to atmospheric changes and disturbances that it is almost a matter of necessity that an elementary knowledge of different cloud formations be acquired to supplement the information as to Hurricane Warnings contained in the issue of the *Agricultural News* of June 30, 1917.

There are four primary forms of clouds:—

Cirrus
Cumulus
Stratus
Nimbus.

Cirrus Clouds, which take their name from their resemblance to a lock or curl of hair and are commonly called mare's tails or cat's tails or Pele's Hair, are composed of isolated feathery masses of cloud particles from 15,000 to 30 000 feet in the higher regions of the atmosphere, so far above the surface of the earth that these particles are generally in the condition of ice crystals. It is chiefly to do with Cirrus clouds that haloes appear round the sun and moon. There are two distinct forms of Cirrus clouds. The first form, like feathery shafts, commence to appear when a cyclone is 300 to 400 miles away and spread out like a fan from a spot on the horizon, indicating the centre of the disturbance and giving warning of a storm of small diameter but of considerable force, while the second kind are of zone shape and of large diameter forecasting a storm of moderate strength. The upper currents of Cirrus clouds afford more information as to its situation and force while the storm is still at some distance, but, when the vortex is near at hand the movements of the lower clouds are more reliable guides in determining the position and direction of the centre.

Cumulus or Heap Clouds consist of dense masses of cloud formation collected in the lower regions of the atmosphere (4,500 to 7,500 feet) where the amount of water vapour is greatest, and are humpback on the top with flat bases. They are, as a rule, produced by the ascending daily air currents carrying the warm moisture to the upper regions, where the clouds are chilled by the cold of elevation and expansion.

Stratus or Layer Clouds occur in the form of horizontal bands or layers, and are due to the gradual settling of the other clouds, for which reason they are common in the early morning and late evening, when the ascending currents of air are weak. This form of cloud is the least elevated of all, being under 3,000 feet, and often becoming fog by falling to the surface of the earth.

Nimbus, or Rain Clouds, are dense masses of formless clouds with ragged edges, through which are often seen Cirro-Stratus clouds. When the mass of nimbus is broken up into small fragments, or if portions float below the cloud, they are called 'scud'.

The chief secondary forms of clouds are:—

Cirro-Stratus
Cirro-Cumulus
Cumulo-Stratus

Cirro-Stratus Clouds are whitish layers, usually forming a diaphanous veil and often giving the sky appearance of a mackerel's back; hence such a sky which indicates approaching rain, is known as a mackerel sky.

Cirro-Cumulus Clouds, known as 'Wool Sacks', are Cirrus clouds arranged in little round masses like small cumulus and point to dry weather.

Cumulo-Stratus Clouds resemble mountain masses with a stratus base.



CO-OPERATION AMONG PLANTERS.

There are few, if any, more important activities on the part of mankind than co-operation. There are some forms of activity where individual effort is best, and, in fact, is all that is needed, but most of our activities are greatly helped by combined activity on the part of the persons interested in a given line of work. The reason that a company or business concern succeeds, is because it is composed of a group of men, consciously working toward some definite end. By developing the proper system of co-operation it is possible for a community or group of communities to achieve much more than would be possible, were each member working independently.

Co-operation is more than merely a method of doing business. It is, as is explained, in the *Extension Bulletin No. 1 of the Hawaii Agricultural Experiment Station*, a principle, a motive, an incentive for human action, which, if adopted by the community, will make it more united and more prosperous. Before, however, a co-operative idea can be manifested in the business of a community, it must first of all work itself into the lives of the individuals of that community. It is important, therefore, to keep on cultivating the habit of working together for some common end or ends, social or commercial. Some co-operative activities are much more readily carried out than others. Co-operative business enterprises are usually difficult to keep running smoothly at all times, for they frequently curtail individual freedom of action along business lines, a condition which is often irksome to individuals long accustomed to untrammelled freedom of individual activity. For this reason such co-operative business ventures as to prove successful are those which are called into being to meet some very evident need, and from the first are of such apparent benefit as to survive the early critical period of their existence. The idea which underlies the word 'co-operation' is that of working *with* one another *for* one another—of working each for all and all for each. The benefits are founded on the old saying that 'in union there is strength'.

Increasing the British-Grown Wheat Supply.—It appears that a large amount of attention is being devoted to the seed selection of wheat in the United Kingdom, obviously with the idea of increasing the yield per acre to the very highest possible degree. At Cambridge, wheats are bred with the object of providing for British soils and climates, varieties which are likely to raise the already high yields per acre of grain and straw obtained in that country, and in all but abnormally bad seasons to provide millers with the raw material from which flour can be obtained in the highest degree suitable, primarily, for the requirements of bread bakers in the districts where the wheats are grown. Results of great economic and technical importance are being obtained. Thousands of selections are being tested so that in each season, and for some years to come, one or more varieties may be issued at moderate prices to agriculturists. Such wheats will be grown in all parts of the Kingdom, and in due course each new variety will find its most suitable environment.

In the article in the *Bulletin of the Imperial Institute* under notice, reference is made to the policy of the Imperial Department of Agriculture for the West Indies, in the matter of directing attention to the necessity for cultivating crops yielding substitutes for wheat flour in the West Indies.

AGRICULTURE AND THE WAR.

Although the entrance of the United States into the war is, of course, too recent to expect extensive developments and important results, attention may, however, be drawn to the fact that the Federal Government has already organized an inter-departmental committee to formulate a programme for food production and conservation and has a number of plans under consideration. Among these, as is announced in the *Experiment Station Record*, for May 1917, Vol. 36, No. 7, is a material expansion of the work of the Department of Agriculture, enlarging its forces for co-operative demonstration work, home economies, the combating of destructive pests, the utilization of methods for the preservation of perishable products, the safeguarding of seed supplies for 1918, the market news service, assisting in the labour problem, and otherwise to stimulate production, improve distribution, and to promote conservation of the food supply. The appointment of a small number of agricultural leaders to give advice as regards national problems, and the creation in each State of a small central division of food production and conservation composed of representatives of the various agricultural and related interests, as well as the formation of county township, or urban bodies of similar constitution to work in close co-operation with the State central agency are also suggested. It is estimated that approximately \$25,000,000 will be required to carry these plans into operation. Nor have our French allies passed unheeded the lessons of the war which have so clearly demonstrated the necessity for the establishment of national laboratories of scientific research and institutions for research in agriculture. A report of a special commission presented to the French Academy of Science describes in detail the experiment station system of the United States which is highly commended. This system is contrasted with the stations and laboratories in France for which the Government voted 339,700 francs (about £14,000). The sum is shown to be quite inadequate and to result in limiting the field work and expensive investigations and in restricting considerably the routine functions. At present the French station is usually devoted to a single branch of industry. The commission argues for fewer stations located in typical agricultural areas and well organized to cover the various phases of the industries, with specialists in each. It is also suggested that the stations should seek the collaboration of farmers, as the Danes have done in their experimental work. What the commission regards as serious obstacles are the comparative isolation of the station from one another and their lack of central supervision. It advocates the appointment of a permanent superior council to guide and direct the work of the stations, assure the proper use of the funds at their disposal, provide for meetings of their personnel from time to time, publish results of their work and abstracts of material of interest appearing elsewhere, and otherwise correlate and invite the scattered institutions into a national system. The establishment of a well-equipped central station charged with work of a strictly scientific nature of interest to the whole country, or of such scope and importance that it could not be carried on to the best advantage at the district stations is also favoured.

In the *St. Vincent Sentry* of June 15, 1917, it is announced that a new steamship line between Philadelphia and the West Indies has been established by the Philadelphia Shipping Co. Under the plans that have been formed the vessels, which fly the American flag, will touch at Porto Rico, the Virgin Islands, the Windward and Leeward Islands, Trinidad and other West Indian and Central American ports.

EXAMINATIONS IN PRACTICAL AGRICULTURE, 1916.

The publication of the results of the examination in practical agriculture conducted by the Imperial Department of Agriculture for the West Indies in November last has been unavoidably delayed. It is now possible to give a statement of the results, which were as follows. Candidates entered for the examinations from two islands, namely, St. Vincent and Antigua.

SUCCESSFUL CANDIDATES.

Name.	Examination.	Class.
C. V. D. Hadley	Preliminary	1st
R. E. Lockhart	"	3rd
Floris Simmons	Final	2nd
Total number of candidates, St. Vincent, 3.		
H. E. McDonald	Preliminary	1st
G. T. G. Michael	"	1st
V. G. Pereira	"	1st
E. A. Thompson	"	3rd

Total number of candidates, Antigua, 4.

The foregoing shows that the results were, in general, very satisfactory; but it is desirable that a still larger number of candidates should enter for these examinations this year, and that those also who have passed the preliminary examination should carry on their studies with a view to passing the intermediate as soon as possible. An account of these examinations will be found in the *Agricultural News*, Vol. XIII, No. 308, p. 61, and Vol. XIV, No. 332, p. 29.

RAINFALL IN ANTIGUA IN 1916.

The return of rainfall for seventy-four stations in Antigua for the year ended December 31, 1916, shows a monthly mean as follows:—

January	5.15
February	2.23
March	1.93
April	2.24
May	4.45
June	2.37
July	6.44
August	5.71
September	3.83
October	12.34
November	9.83
December	1.71

with an average rainfall for the year of 58.23 inches.

During the period of forty-three years between 1874 and 1916 the average annual rainfall is 45.23, so that the rainfall for last year is 13.00 inches above the average. The lowest average yearly rainfall for the period in question was 28.78 inches in 1875, while the maximum is 73.59 inches in 1889.

The rainfall for the period of five years ended 1916 is:—

1912	32.2
1913	42.76
1914	36.86
1915	56.14
1916	58.23

According to Mr. W. Fishlock, Curator, Experiment Station, Tortola, British Virgin Islands, the last season's cotton crop came to an end in May, and, so far as dealings at the station are concerned, has been smaller than usual. It appears that prospects for the coming crop are a little uncertain.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market for the month of May 1917:—

The month of May begun with a fair amount of business in products that come under notice in this column, and this in spite of increased cost of freightage and the general tendency to advance prices all round, not only in overseas products, but in all others. Especial note may be given to ginger, citric acid, sarsaparilla, oil of limes and mace, as commanding higher prices.

GINGER.

At the beginning of the month, the quotations for Sierra Leone were 47s. per cwt. No Jamaica was offered, but at auction on the 23rd it was reported that at Liverpool medium and good Jamaica were quoted at 95s. to 105s. per cwt., and common to good common at 90s. to 92s. 6d. At auction in London on the same date the offerings were as follows: 617 bags of Cochin and Calicut; of these, 300 bags of good washed sold at 70s. per cwt., while 221 bags of fair limed Japan were held at 52s.

Mace was represented at the sale on the 9th of the month by 17 packages of West Indian, which realized 2s. 1d. to 2s. 3d. per lb. for fair to good pale, and 1s. 10d. for dull. At auction on the 23rd, 63 packages were offered and sold, fair reddish fetching 2s. 2d. to 2s. 4d. per lb., ordinary and wormy 1s. 8d. to 2s., and pickings 1s. 4d. to 1s. 7d.

SARSAPARILLA.

At auction on the 2nd of the month, sarsaparilla was in good supply, being represented by 5 bales of grey Jamaica, 25 of Lima-Jamaica, 14 of native Jamaica, and 25 of Mexican. There was a keen demand for the grey Jamaica, as the drug has been very scarce of late, consequently all were sold at the following rates: 3s. 2d. to 3s. 5d. for ordinary to fair, and 2s. 10d. for coarse and damaged. Of the Lima-Jamaica 7 bales only were sold, fair, part chumpy realizing 2s. 10d., and chumpy 2s. 6d. Only 4 bales of the native Jamaica found purchasers at 1s. 4d. for damp, press-packed. The Mexican failed to find a buyer, though it was said that previous to the auction some sales had been effected.

CITRIC ACID, KOLA, ANNATTO SEED, CASSIA FISTULA, LIME JUICE, LIME OIL, ARROWROOT AND PIMENTO.

At the beginning of the month citric acid had advanced to 3s. 6d. per lb., which price it maintained to the end of the month with the additional note that it was difficult to obtain. Kola has been, and is still, in great demand. At auction on the 3rd of the month as many as 257 packages were offered, and all sold at the following rates: 6d. per lb. for dull Jamaica at which rate 246 bags were disposed of; 5d. was paid for dull Ceylon and 3d. for wormy. Annatto seed to the extent of 35 packages was offered at auction on the 3rd of the month, but failed to find any purchasers. Twenty-five bales of Cassia Fistula pods, were also offered at the same auction and a sale of 25 bales of slightly wormy pods was made at 50s. per cwt. Some 13 puncheons of lime juice were also offered, but failed to find a buyer. For hand-pressed lime oil 17s. 6d. was asked about the middle of the month. Arrowroot has been very firm throughout the month, 6d. per lb. being the quotation for St. Vincent. There has also been a very quiet demand for pimento, 3½d. per lb. being the price quoted.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
June 14, 1917.

ARROWROOT—5d. to 6½d.
BALATA—Block, 3/ to 3/1; Sheet, 3/11 to 3/11½.
BEESWAX—No quotations.
CACAO—Trinidad, 86/-; Grenada, 68/- to 82/6; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£45 15s. to £46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £41 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, 90/- to 110/-.
ISINGLASS—No quotations.
HONEY—Jamaica, 75s. to 105s.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—3¾d.
RUBBER—Para, fine hard, 3/1; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, 5/8 to 5/9.

New York.—Messrs GILLESPIE BROS. & Co., June 26, 1917.

CACAO—Caracas, 12¾c. to 12¾c.; Grenada, 12c. to 12½c.; Trinidad, 11¾c. to 12½c.; Jamaica, 10¾c. to 11½c.
COCO-NUTS—Jamaica and Trinidad selects, \$40.00 to \$42.00; culls, \$24.00 to \$25.00.
COFFEE—Jamaica, 9¾c. to 11½c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 80c.; Antigua and Barbados, 70c. to 80c.; St. Thomas and St. Kitts 65c. to 75c. per lb.
GRAPE FRUIT—Jamaica, \$1.75 to \$2.25.
LIMES—\$7.25 to \$8.00.
MACE—38c. to 43c. per lb.
NUTMEGS—21c. to 26c.
ORANGES—\$1.50 to \$2.00.
PIMENTO—6½c. per lb.
SUGAR—Centrifugals, 96°, 6.02c; Muscovados, 89°, 5.16c.; Molasses, 89°, 5.00c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., June 22, 1917.

CACAO—Venezuelan, \$11.80; Trinidad, \$11.25 to \$11.75.
COCO-NUT OIL—\$1.12 per Imperial gallon.
COFFEE—Venezuelan, 10c. to 12c.
COPRA—No quotations.
DHAL—No quotations
ONIONS—\$4.50 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$5.75 per 100 lb.
RICE—Yellow, \$9.50 to \$10.00; White, \$6.75 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., June 25, 1917.

ARROWROOT—\$6.00 per 100 lb.
CACAO—\$12.50 per 100 lb.
COCO-NUTS—\$26.40 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$4.50.
PEAS, SPLIT—\$12.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$9.50; Patna, no quotations; Rangoon no quotations.
SUGAR—Muscovado centrifugals, \$4.50 to \$5.00.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'badon		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



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Whatever may have been the success, in the past, in producing large yields and good qualities, no operations having an important bearing upon the commercial results of the lime industry have been so generally ignored as grading and packing. Some of the larger producers have awakened to the necessity for improving their methods, but the majority of the small growers still cling tenaciously to the old evil ways. The whole matter is so simple and appeals so directly to common-sense that it is difficult to understand this too prevalent neglect of their own interests. There may be other obstacles in the road to financial success in the exportation of green limes, but want of care in packing is entirely the creation of the producer.

In gathering limes for exportation the grower has to consider that they have to be packed to travel in close holds for many days, and it is obvious that those that are overripe at starting are likely to be almost unuseable on arrival at their destination. Again, if limes of different sizes are shipped, they should be shipped in separate packages under a different mark and not be allowed to detract from the market value of the other grades.

Grading and Packing Fruit.

FROM the *Dominica Chronicle* of May 23, 1917, it appears that the question of the shipping of inferior fruit and ways and means to combat the evil was being discussed, and that the local Government had offered its co-operation. The subject, which is of vital importance to the fruit industry of any colony, has often been considered in the West Indies, but effective measures have, unfortunately, never as yet been taken.

It is especially to the interest of the small lime growers that attention should be aroused as to the importance of accurate grading and careful packing, for they are more seriously affected thereby than those who produce on a large scale and have other ways open to dispose of their fruit. In small shipments only the best prices can leave a margin for profit, and only the best produce, well sorted and judiciously and honestly packed, will bring the leading prices. After a time, small growers will find by bitter experience that it is

better to retain inferior grades of fruit than to ship their entire crops to market, without discrimination. Fruit prepared with taste and judgment possess, when submitted to the purchaser, an attractiveness that benefits the producer as much as unsparing labour and good cultivation have aided him in its production. Persistent disregard to the importance of accurate grading and careful packing and the regrettable action of producers in shipping immature or overripe products, have done more than anything else to jeopardize the future of the West Indian fruit industry.

The present situation in Dominica demonstrates, once more, the urgency for establishing uniform standard grades for fruits to be exported from the West Indies so as to establish fixed bases upon which producer and importer can deal. Two systems exist for attaining this end, one being Government inspection, the other inspection and grading by co-operative associations which need not necessarily be formed for trading purposes.

With regard to official inspection, the Colonial Secretary of Jamaica at the Conference of the Imperial Department of Agriculture held in 1902 proposed a general scheme on the lines of that adopted in Canada, the main features of which were the establishment of a complete register of growers and packers with licences for packing houses; the marking of packages with the name of the packer and the packing house; the establishment of standard grades for size and quality of fruit throughout the West Indies; the inspection of packing houses and packages by proper inspectors at any point before shipment; and the presence of a responsible agent in the principal purchasing markets. Up to the present, however, legislative action has not been taken, partly, perhaps, on account of friction to be anticipated at what might be regarded as official restriction on private enterprise, and, partly, perhaps, on account of the large expenditure which the employment of numerous skilled inspectors would entail. There is, moreover, the necessity for considering the limitations of the fruit growers and the peculiar conditions existing in these islands. Fruit plots are frequently miles from the place of shipment, and fruit has to be packed on the spot to protect it from injury in its transport over rough roads. The crop is perishable and has to be handled quickly, and the packing has to be done by inexperienced persons to save the cost of employing an expert packer. Under these and many other circumstances, it would be disastrous to enact arbitrary and critical standards for packing or for maturity.

It seems, therefore, that, instead of awaiting official action, it will be wiser to endeavour to secure improvement in the grading of West Indian fruits through the medium of voluntary co-operative association. There are obvious benefits, educative as well as commercial, to be gained by growers acting together voluntarily in this matter, and this system has in many parts of the United States proved to be the most successful method of securing a uniform grade of perishable products, properly packed in standard packages. In Florida, California, Virginia and other States, where, as reported in *Farmer's Bulletin* 753, farmers have found it necessary, in order to build up a profitable business in potatoes and gain a reputation for shipping products of high quality, to establish their own associations or private packing plants in which the produce of the growers may be graded and packed by skilled workers, these organizations supply the greater part of standardized fruit found upon the American market at the present time. In one district in Virginia, the management of the growers' co-operative organization, which ships large quantities of potatoes, strongly believes that the proper grading of the crop is of primary importance. Although this association has become widely known for its dependable output, the management is not yet satisfied with present results but is aiming at standardizing its shipments even more accurately. An inspector is employed at each of the leading stations maintained by the organization, and a chief inspector superintends the work of all. These inspectors are held strictly responsible for the grade of shipments leaving their stations, and each realizes that his standing with the association depends largely upon how much of the produce inspected and shipped by him is eventually rejected or forms the cause of complaints on arrival in the markets.

In Sicily, of which one of the most important industries is the cultivation of the lemon, the great rival of the lime in the American and other markets, exists an association, to which the majority of the shippers belong and which protects the members in various ways and looks after their interests. The Sicilian lemon is graded and packed to meet the requirements of the different markets. There is little difference in the packing for the different countries, except that the English market prefers large-sized lemons, whereas the American, which requires the small fruit, takes a large-sized case as well as the regular size. The Russian market requires a medium-sized fruit, but of the best quality.

Coming nearer home, we have before us an example of what excellent results can be gained by voluntary association in the work of the Antigua and Montserrat Growers' Associations, and it would be well worthy of the consideration of the Dominica lime growers whether the principle could not, with advantage, be applied to their industry in order to eliminate, to a great extent, that undesirable feature, the speculative element that attends every transaction, and to prevent inferior fruit being delivered when there is reason to expect excellence. The local Government, of course, could be of assistance by protecting from infringement the brands registered as trade marks, and in all other reasonable ways.

PRACTICAL HINTS FOR PACKING.

In connexion with the subject of grading and packing limes dealt with in the editorial of this issue, an article written in the *West Indian Bulletin*, Vol. XI, p. 153, by the Agricultural Superintendent of St. Vincent, Mr. W. N. Sands, after a visit to New York, paid at the suggestion of the Imperial Commissioner of Agriculture to ascertain the conditions of that market in regard to West Indian limes, will be of great interest.

It was pointed out by those intimately connected with the lime trade that if the limes were packed in half-barrels they would arrive in better condition. It was not recommended that this fruit should be packed and shipped in cases, as oranges and other fruit, even though this admits of closer storage, the reason being that such packages are only suitable for limes where there is cold storage. The demand on the part of the fruit dealers was for sound, thin-skinned, clean and bright limes, of medium size. The chief complaints were in regard to the smallness of some of the limes shipped, the largeness of others, the coarseness of the rind, the discoloration by dirt, black blight and scale insects. The packages, too, should be made from imported shooks, for they would have a clean and neat appearance in marked contrast with the dirty-looking flour barrels of various sizes in which the limes were frequently shipped from the West Indies. All packages should be provided with holes in perpendicular lines for ventilation and tightly packed to prevent the limes being bruised. Each separate lime should be wrapped in brown wrapping-paper which was found to be superior to rice paper or tissue paper, because it absorbed the products of decay to a certain extent. In the packages the limes should be arranged in definite layers.

The article concludes by summarizing the recommendations it contains as follows: 'In order to obtain the best results growers and shippers must give close attention to the following matters: (a) the fruit should be carefully picked, cured and graded, so that only perfectly sound and clean limes will be shipped; (b) limes, discoloured with earth, scale insects or black blight, should be sponged or brushed, after the fruits have been cured for a day or two, care being taken not to injure the skin in any way; (c) the fruit should be allowed to dry thoroughly after being cleaned, and then wrapped in brown wrapping-paper; (d) in selecting the fruit it would appear that a lime measuring from $1\frac{3}{4}$ to $1\frac{7}{8}$ inches in diameter is the size desired by buyers, and grading to this size should be adopted; and (e) the fruit should be packed closely, in layers, in well ventilated barrels of

standard size.' The writer of the article expresses the opinion that, if growers and shippers select, grade and pack the limes according to the methods thus described, and keep in close touch with the requirements of the buyers, there is no reason why British West Indian limes should not continue to control the New York market and realize remunerative prices.

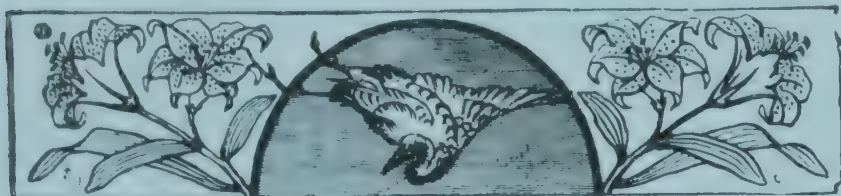
The Antigua and Montserrat Onion Growers' Association have wisely been instrumental in bringing about, by careful grading, an increased export of their crops. To meet the popular demand which varies in the different markets, small onions being preferred in the West Indies and British Guiana and large ones in the Canadian and New York markets, onions are now arranged into four grades according to size, as follows:—

- | | | |
|---|--------|--|
| 1 | Onions | $2\frac{1}{2}$ to 3 inches in diameter. |
| 2 | " | over 3 inches in diameter. |
| 3 | " | 2 inches to $2\frac{1}{2}$ inches in diameter. |
| 4 | " | under 2 inches. |

The device employed in grading onions is very simple, and consists of a board with holes cut in it corresponding in size to the limits of the various grades, the grader being raised on legs of sufficient height to permit baskets being placed under it. The operation of grading consists in ascertaining which of the various holes is the smallest through which any onion will pass.

Exportation of Molasses from the West Indies.—Although the exportation of molasses from the West Indies to any country not within the British Empire has been prohibited, it has been found expedient, as is announced in the *Official Gazette* of Barbados, July 5, 1917, for the Governor-in-Executive Committee to make an Order granting licences for the shipping of a limited quantity of molasses to the United States on condition that no molasses so exported are to be re-exported to any country except the Dominion of Canada. For the purpose of enforcing this condition, shippers of molasses from Barbados to the United States shall on every shipment make a statement setting forth the quantity shipped, the name of the ship and the name and address of the purchaser and consignee, and, shall, within a reasonable time, produce to the Comptroller a certificate from the consignee, showing that he has received the molasses and giving an undertaking that none will be shipped to any country but Canada.

Ground Nuts in the United States.—In the eight years between 1908 and 1916 the value of the yield of ground-nuts in the United States increased, according to *Agriculture* of March 1917, from \$12,000,000 to \$56,000,000. the reason for this enormous increase being that ground nuts are being largely planted in the place of cotton, which it is impossible to cultivate on account of the boll weevil. It has been found that by slight adjustments of machinery cotton-seed mills can be turned into ground-nut oil factories. It appears that there is little likelihood of the markets being glutted with ground-nut oil and cake because the food value is such as to make a universal market for the product. Experiments are being made by the United States Government to discover the best use for the ground nut and to popularize it with American kitchens, and the Chemistry Bureau of the Department of Agriculture recently began researches that are expected to produce from ground-nut meal a bread equal in value for food and tastefulness to wheat bread.



DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. During the month of May, work in the Botanic Gardens was of a general routine nature. Plant distribution was considerably below the average. In his observations relating to staple crops, the Agricultural Superintendent (Mr. W. N. Sands) states that preliminary operations were undertaken in all districts for planting up lands in staple products and food crops; the weather, however, was too dry to allow of much planting being done. Indications pointed to the fact that far larger areas of land would be put under cultivation than for some years past. The available labour supply would, however, be the limiting factor. The Agricultural Superintendent addressed well attended meetings of small owners and peasants on the war, and local food problems and staple products. The Imperial Commissioner (Sir Francis Watts, K.C.M.G.) paid a visit on the 13th instant on his way back to Barbados and discussed with His Honour the Administrator and the Agricultural Superintendent agricultural and economic questions. The weather during the month was fairly dry, the rainfall recorded at the Botanic and Experiment Stations being 5.11 and 3.93 inches, respectively.

In his report for the month of June, also to hand, Mr. Sands states that plant distribution consisted of 1,063 cane cuttings of selected varieties and 10½ lb. cotton seed, of a strain grown at the Botanic Station. Work in the Botanic and Experiment Stations was similar to that recorded for the month of May. As regards staple crops the report is more encouraging. The rains, writes Mr. Sands, although rather later than usual, came in and enabled the work of preparation and planting of lands for various crops to be proceeded with on a large scale. The cotton seeds sown had germinated well, and there had so far been no difficulty in getting a good stand of young plants. Up to the end of June about 9,000 lb. of selected cotton seed had been sold, since the season opened, at the Government Cotton Ginney. The stock of corn meal at the Ginney was all disposed of at the beginning of the month.

Regarding special work of officers of the Department it is mentioned that visits were paid to Young's Island to establish a cotton plot to obtain a pure supply of cotton seed for general planting, and to Ratho Mill estate to investigate a report that cotton stainers were breeding on the milk bush (*Tabernaemontana citrifolia*), and the red-head bush or wild Ipecacuanha (*Asclepias curassavica*). The report proved, however, to be without foundation, as the insect breeding was not the cotton stainer. At Grand Sable and Mt Bentinck estates, young cotton fields and lands being prepared for cotton and canes by means of modern implements were inspected. The successful use of a gasoline torch in connexion with traps for the destruction of cotton stainers is recorded. A quick and inexpensive method of destroying the insects has been devised, which has the further advantage that the cotton seed traps do not lose their power of attracting the insects. A circular has been issued to planters suggesting measures which should be taken, besides the destruction of their native food plants, for effectively eradicating the cotton stainer.

The rainfall for the month was—Botanic Station 11.85 inches, Experiment Station 10.32 inches.

ST. LUCIA. The Agricultural Superintendent, Mr. A. J. Brooks reports plant distribution during the month of June as follows: grafted mangoes 19, ornamental plants 39, budded oranges 26, cacao 52, economic 8, and lime plants 8,200; there were also distributed 36 packets vegetable seeds, and 1¼ lb. Castilloa seed collected and sent to Egypt. In regard to staple crops it is stated that cacao trees were flowering, the lime crop was coming in, and good growth being made with sugar-canes. The special work of visiting properties of the peasants and regularly supplying limes to the Government Lime Factory was commenced by the Agricultural Officers in the Gros-Islet and Dauphin districts. This work is considered of great importance and will be continued systematically. The severe drought, which had practically lasted from December, broke up on June 9. Thunderstorms have been of almost daily occurrence during the last fortnight. On Friday June 29 a severe storm broke over the southern part of the island. The lightning was very intense and lasted all day, being most severe between 5 p.m. and 7 p.m. The wind swept in continual strong gusts and did some amount of damage to shade trees, etc. Record falls of rain were registered on some estates. Starting at Vieux-Fort (the southern end of the island) and following along the Leeward Coast to the northern end of the island the rainfall recorded was as follows: Vieux-Fort, 1.84 inches, Choiseul 2.90, Soufrière 7.00 inches, Anse-la-Raye 2.23 inches, Castries Gardens 1.80 inches, Gros Islet 1.00 inch. Telephonic communication between Castries and all the country districts was completely cut off and all partially restored after twenty-four hours. Landslides occurred here and there in new clearings; the rivers were in flood, and in one case swept away a large stone wall built to protect the adjoining cultivation from flood. Considering the force of the storm, little apparent damage, on the whole, was done, although cacao trees in certain districts which were heavily in flower must have suffered from damage to the blossom.

Mr. W. Nowell, Mycologist on the staff of the Imperial Department of Agriculture, called at the Gardens on his way to Dominica and discussed matters of interest with the Agricultural Superintendent. At the request of His Honour the Administrator the Agricultural Superintendent is preparing a complete set of lessons to assist the teachers at the primary school in teaching agricultural subjects. These lessons when completed will cover the whole of the agricultural syllabus as laid down in the Code of Rules approved by the Governor-in-Council on September 3, 1909.

ANTIGUA. Ordinary routine work was performed in the Botanic Gardens during the month of June, while plant distribution consisted of bay seedlings 735, limes 600, coco-nuts 64, decorative 25, sweet potato cuttings 23,200, 11 packets miscellaneous and 815 lb. of cotton seed. The quantity of cotton seed distributed for the season amounted to 2,360 lb. Good rains were experienced during the month, in consequence of which the cane crop improved considerably. The cotton crop has also recently made good growth. Mr. Jackson states that extension of activity in connexion with the sisal industry may be looked for in the near future, 100,000 plants of sisal having been ordered from Anguilla for planting in the windward districts of Antigua. Some 100,000 beetles of *Exophthalmus esuriens* were caught on one estate during the month. A meeting of peasants was held at Sawoolts estate in connexion with the sale of Crown Lands. The Antigua Grammar School Boys attended the School Gardens regularly, budding, grafting and the examination of cotton lint being the main points dealt with during the month. The

rainfall for the month was 6.82 inches; this has done a considerable amount of good: it gave to planters a much needed opportunity to plant provision crops, of which there is a fair quantity now being established in Antigua.

MONTSEERRAT. Mr. W. Robson writes to say that the weather during the month of June was, on the whole, favourable for work in the Experiment Station and most of the plots are now occupied with crops. Plant distribution included, 50 lb. pigeon peas for planting purposes, 200 bay plants, 24 lb. bread-and-cheese seed, 4 lb. sword beans and 8 packages of cowpeas. Further trial is being made with pigeon peas as a support to beans of the *Stizolobium* class, as well as Lima beans. Two new bonavist beans as well as seeds of the American horse mint, were received and sown. Two distillations of bay leaves were conducted and a start was made to collect and sow seeds of the bay trees. Five pounds of onion seed were received for trial, part of which will be grown in the station and the remainder distributed for trial. Regarding staple crops, Mr Robson states that the ample rains at the end of the month left the position as regards the cotton crop very much improved, and first pickings had been made from some of the March-planted fields. Dull weather prevailed on a considerable number of days and this had a bad effect on growing cotton plants the growth then being attenuated and soft. It is to be feared that a large number of cotton planters, especially small growers, are growing cotton on the same land year after year without any manure. The rains have come in time to benefit the lime crop now on the trees. Little new planting of limes is being done, the cultivation of cotton coming before other crops at the present time. The collection of cotton stainers was necessary on one area, in which the pests, as a rule, are troublesome. Legislative action is being considered in connexion with the destruction of the host plants of the cotton stainers. On the whole, the activity shown in the planting of vegetables is satisfactory. At a special meeting of the Agricultural Society the question of providing a continued supply of local-grown foodstuffs was considered. At this meeting a resolution was adopted, urging the Government to take action to prevent the emigration of labourers from the island, San Domingo at the present time having particular attractions. The Government proposed taking action to prevent the exportation of the whole of the sugar crop, in view of the scarcity of the foodstuffs. The rainfall for the month at Grove Station was 8.56 inches. Most of the rain fell in the first and last week the weather from the 5th to the 23rd being comparatively dry. Total rainfall for the year was 25.26 inches.

ST. KITTS. In the month of June plants distributed included 2,300 sweet potato cuttings, 52 lb peanuts, 50 lb. Indian corn, and 43 Mazzagua corn. In addition 300 lb. of Indian corn seed were procured and forwarded for planting in Anguilla. Work in the Botanic Gardens was of a routine nature. Touching staple crops, Mr. Shepherd says that the estates in the Central Factory had all finished reaping and the Factory closed down at the end of the month. The total crop will not be far short of 11,800 tons. Many of the estates were below their original estimate owing to the dry weather in the early part of the year, while the large cane fires were also responsible for some loss. The muscovado estates are still grinding. The young cane crop is very backward on many estates, but the recent showers will bring them on. A large area is being planted on estates in provisions of all kinds in consequence of scarcity of imported foodstuffs, and a fairly large area has been put under corn in the Sandy Point district. A large acreage has been put under cotton, and the young plants are looking strong and vigorous in all districts. Some cotton had been already picked from seed sown in February in the

Northern district. Leaf-blister mite has been observed in the earlier planted cotton, some of which had to be pulled up to prevent the spread of the pest. An invasion of *Exophthalmus esuriens* beetles was met with at the Experiment Station and large numbers were killed in the hearts of the young cane. Considerable attention has been paid to raising crops of cowpeas and Para peas supplied from the Experiment Station, and the results are satisfactory. Rainfall for the month was 6.13 inches, for the year 16.79 inches.

TORTOLA. Mr. W. C. Fishlock, reporting for the month of May, states that in the Experiment Station the work of preparing land for cotton and other crops was pushed on as far as weather conditions permitted. The last season's cotton crop had come to an end and so far as dealings at the station were concerned, it was the smallest on record since 1907. Prospects for the coming crop were somewhat doubtful. During the month the weather was dry. Rain fell in measureable quantity on nine days of the month, the total fall at the station being 2.64 inches. The average for the same month for the previous sixteen years was 4.79 inches.

Reporting for the month of June, it is stated that with favourable weather conditions, the work of preparing land and planting crops in the Experiment Stations was being pushed on. Plant and seed distribution consisted of: sweet potato cuttings 300, ornamental 3, cotton seed 234 lb, vegetable seed 12 packets. The general condition of crops had improved with the coming of good rains; the peasantry were busily planting food crops and a certain amount of cotton was being planted. A meeting in connexion with the food problem was held on 13th instant. The total rainfall recorded at the Station was 6.43 inches.

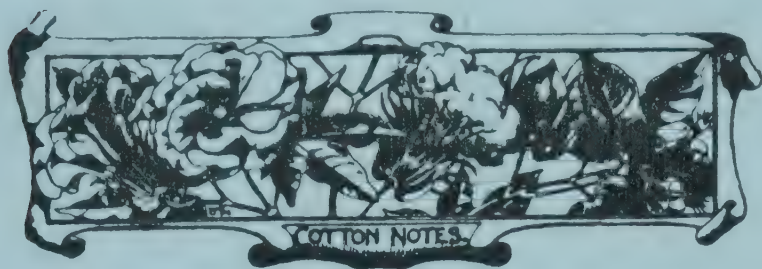
DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture returned recently to Barbados from an official visit to Antigua in connexion with various matters pertaining to the agriculture of the Leeward Islands.

Dr. J. C. Hutson, B.A., Ph.D, Entomologist on the Staff of the Imperial Department of Agriculture has returned from an official visit to St. Lucia where he has been conducting investigations connected with insect pests in that island.

Mr. S. C. Harland, B.Sc., Assistant agricultural Superintendent, St. Vincent, called at the Head Office on his way to St. Vincent after three months vacation leave in Canada.

The Order-in-Council, dated March 31, 1917, published in the *Canada Gazette* of April 14, 1917, specifies the new standards of quality for flavouring extracts, and defines lemon extract as: the flavouring extract prepared from lemon peel, or from oil of lemon, and containing along with more or less of the terpenes of lemon oil, not less than two-tenths (.2) of 1 per cent. of citral derived from oil of lemon. Terpene lemon extract is the flavouring extract prepared as above described and contains not less than 5 per cent. of oil of lemon and not less than two-tenths (.2) of 1 per cent. of citral derived from oil of lemon.



COTTON.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending June 30, 1917, is as follows:—

ISLANDS. The market is closed for the season as the crop has all been marketed and sold.

The new crop (1917-18) will not be marketed much, if any, before October.

GEORGIAS AND FLORIDAS. The receipts since our last circular of June 2 have been 167 bales, and sales 283 bales.

The market has remained dull with limited demand, the above sales consisting largely of cotton held by exporters which they succeeded in placing either on forward sales or on small orders from spinners.

The stock left in Factors' hands is very small, amounting to less than 300 bales, consisting principally of the lower grades, and is held 1c. to 2c. above the official quotations, yet with actual offer one may buy at some concession. The larger portion of the stock is either held to cover forward sales or on speculation, and kept off the market expecting a further advance.

However, with the new crop coming to market very soon, and with the stock held by spinners as reported by the U.S. Census Bureau, we do not see how the present prices will be maintained. The following Exchange quotations are based on small sales made, viz:

GEORGIAS AND FLORIDAS.

Extra Choice & Fancy 70c. = 72½c. landed.

Choice & Extra Choice 69c. = 71½c. „

Extra Fine & Choice 67c. = 69½c. „

The exports from Savannah since June 2 were 283 bales, to Northern Mills, and from Jacksonville 1,277 bales, also to Northern Mills.

CROP ADVICES:

ISLANDS. As previously reported, there has been some increase in acreage, and in consequence estimates for the coming crop range around 8,000 bales to 10,000 bales, depending on weather conditions. At present the plant is reported in some locations to have an unhealthy appearance, attributed to unseasonable cool nights and lack of rain. The expectation is that the outlook will improve from now on.

GEORGIA AND FLORIDA. There has been an increase in acreage, ranging from 10 per cent. to 30 per cent. The quantity of fertilizers used is about the same as last year, but the grade is lower on account of absence of potash. The condition of the crop, taken as a whole, is fair, but is two or three weeks late on account of the cool spring having retarded the growth. This is unfortunate, as the boll weevil has already made its appearance in some sections, rendering planters most apprehensive. The final outturn is of course dependent on weather conditions during the next three months, and should these conditions be favourable, it is conservative to estimate on a crop fully as large as last year.

THE ANTIGUA COTTON GROWERS' ASSOCIATION.

The Committee of Management of the Antigua Cotton Growers' Association have issued their first report for the year 1916-17, which is of interest, indicating as it does the useful work being done by co-operative effort in that island.

It will be remembered that the Association was formed in May, 1916, as the direct outcome of a resolution passed at the Cotton Conference held in St. Kitts in March of last year. The resolution, which explains the main scope of the objects of the Association, was as follows:—

'Resolved—That, in view of the necessity of taking all precautions to maintain the quality of the cotton produced in West Indian islands, to safeguard the supply of seed, and generally to secure the safety of the industry and also the interests of the growers, it is desirable that a Cotton Growers' Association should be formed in Antigua. And further, that the Delegates of the Cotton Conference are requested to bring this Resolution to the notice of the other cotton-growing islands, with a view to secure similar action, if possible.'

Antigua, up to the present, has been the only island to take co-operative action in the matter.

From the report it appears that the Association early in the season took up the question of supplying pedigree cotton seed to planters. Seed was obtained from Yeptons estate, and, after selection, distributed to growers. In this manner peasants and others had a good strain to plant, as the cotton grown on the estate mentioned had been subjected to selection by officers of the Agricultural Department for some years previously. It was felt that, in some cases, it might be well if small growers were allowed to have seed on the understanding that it would be paid for, when their crops were reaped. After selection, 1,344 lb. of seeds were sent out for planting purposes, this quantity being distributed among thirty-five persons.

At the commencement of the season arrangements were made to purchase clean seed-cotton at 5c. per lb., but, owing to an advance in the market price, this was increased to 8c. per lb. for clean seed-cotton, and 4c. per lb. for stained. The purchases were made under an agreement that the Association should retain all seed and 25 per cent. of any profit made when the lint was sold. A total of 7,249 lb. of seed-cotton was purchased, and the sum spent in purchasing cotton was £115 16s. 9d.

The clean lint after ginning was sold locally for 2s. 8½d. per lb., and the stained lint for 1s. per lb. When distributing second payments, this fact and the difference in the amounts originally paid for stained and clean seed-cotton were taken into consideration. The growers obtained for the second payment 5½c. and 1½c. for each lb. of clean and stained seed-cotton, respectively, sold to the Association. The sum of £75 16s. 1d. was paid out to growers in this way, and it is gratifying that the recipients expressed their satisfaction at the manner in which they had been treated.

The report concludes by saying that the Association will eventually give to the small grower of cotton a sense of security, for he will grow to realize he is obtaining a reasonable price for his produce, and this factor, together with the fact that the Association is doing invaluable work by placing at the disposal of the small growers cotton seed of a known and good strain, will have the effect of improving the cotton now grown in Antigua, and of placing on a firm basis the peasants' cotton industry.

LAND SETTLEMENT IN ANTIGUA.

Rules under section 3 of the Crown Lands (Rules) Ordinance dated June 11, 1917, have been made by the Governor-in-Council in respect of the Crown Lands known as Sawcots estate in the parish of St. Mary's and of such other Crown Lands in Antigua as the Governor may declare them be applicable.

The Crown Lands, after being surveyed, will, subject to the direction of the Governor, be entrusted to the Curator of the Botanic Station. In making the survey, reserves will be made of: (1) all ponds and wells, and banks of any important streams with a space of half a chain around the source or bank; (2) swamps, exposed ridges and forest as may be deemed necessary for forest conservation; (3) lands for sites for churches, schools or other public purposes; (4) lands for roads or paths; and (5) lands requisite for villages or common land. The remainder of the land is to be divided into allotments of not less than one and not more than 3 acres each. In making an allotment, the cultivation of any existing tenant will, if possible, be included, and no allotment of land will be made to any person who is already owner of land, without the sanction of the Governor. The allottee will have to pay one-tenth part of the purchase money at the time when the Conditional Permit is issued, and, at the expiration of one year from the date of such a permit and at the same time in each succeeding year, a further one-tenth part of the purchase money will be paid, so long as any instalment money remains due, the purchase money of an allotment varying from 8s. to 15s. an acre per annum, according to the quality of the land.

A certain proportion will be reserved as common land, on which each allottee may graze not more than two animals of the following class: cattle, horses, or donkeys, in addition to two sheep or goats.

The land reserved for village lots will be laid out in house plots not exceeding 60 feet square each, with suitable space for streets, and every allottee will be entitled to purchase a house spot, the value of which is fixed at the rate of 15s. per annum, on the adjacent village lot, on the same conditions as an allotment may be purchased and held, while house spots may be sold or leased to persons who are not allottees.

As a condition of tenure of allotment, a purchaser must for a period of two years prior to the date of allotment be resident ordinarily in Antigua. No allotment can without the consent of the Governor, be alienated. Alienation does not include involuntary alienation, as in the case of descent or bankruptcy, nor alienation partly involuntary, as in the case of a devise by will. Among other conditions in the tenure are that each allottee shall beneficially occupy the land to the satisfaction of the Governor; that the Government may resume possession of a tenth of the allotment for roads upon paying compensation; that all instalments are punctually paid; and that each holder of a house spot shall provide and maintain in good order a latrine or other sanitary convenience for the use of himself and his family. On the failure by an allottee to comply with these conditions the Governor may, without appeal to any Court, order the right to an allotment, or a house spot, crops, instalments, and other rights, to be forfeited.

At the expiration of ten years from the date of allotment, and, on payment in full, the allottee is entitled to a grant. Should payment in full be made before ten years, no grant or title will be issued, nor may any land be alienated, let or encumbered until ten years have expired. Grants will be recorded in the Land Registry Office free of cost to the allottee, except stamp duty.



FURTHER NOTE ON THE MADAGASCAR BEAN.

In the *Agricultural News* for June 30, 1917, reference was made to the successful production, on a small scale, of the Madagascar bean (a variety of *Phaseolus lunatus*) in St. Lucia. Information has since been received concerning trials with this bean in other islands. In no case has the bean proved a success. From Grenada Mr. J. C. Moore states: 'Madagascar and French White Haricot (both climbers) were received and tried at the Botanic Gardens and at Westerhall Station. At the Botanic Gardens the plants grew weakly, and we got a few seeds from the Madagascar, but none from the French Haricot. At Westerhall the results were also poor, and a few seeds of the Haricot only were saved. The Madagascar failed to seed. Neither kind made robust growth. The seeds of both kinds have again been sown for further trial.' Mr. Moore adds that the Barbuda bean, another form of *Phaseolus lunatus*, and also a local variety much like it, known as Pois chouche (both climbers) have done well on fences at the Botanic Gardens. Six plants of the Barbuda bean, covering 42 feet of fence 5 feet high, were sown on June 20, 1916 and yielded in January-May 1917 dry seed amounting to 3 lb. 11 oz. Pois chouche, four plants of which covered 30 feet of fence, were sown at the same time and yielded in March-May 1917, dry seed weighing 4 lb. 8 oz.

These yields are very satisfactory in themselves, but it must be remembered that the trials like the St. Lucia ones with the Madagascar, were on a very small scale and the results are hardly applicable to field conditions. Mr. Moore has come across a large white-seeded climbing Lima bean which appears to be growing well; he is giving this local variety (also belonging to the *Phaseolus lunatus* group) further trial.

Concerning the results obtained with the Madagascar bean in Antigua, the Superintendent of Agriculture for the Leeward Islands forwards a report of the Curator of the Experiment Station to the effect that 'these beans did not do particularly well at the Experiment Station. Only sufficient seed was obtained from the trial to plant $\frac{1}{10}$ -acre plot.' It is suggested that the yield may be improved by acclimatization.

From St. Kitts, Mr. F. R. Shepherd, the Agricultural Superintendent, writes with reference to the Madagascar and Haricot varieties as follows: 'They both grew well but I failed to obtain any good beans from the Madagascar variety, though I managed to get sufficient from the Haricot to plant a small plot which is now coming on well.'

While in Montserrat, Mr. Shepherd saw a plot of Madagascar beans which appeared to be coming on well, but he does not state what the final result in yield has been.

Summing up, it would appear that at present the Madagascar bean cannot be depended on to furnish a satisfactory yield, though it may improve as the result of acclimatization or if grown in special localities. It is difficult to explain its satisfactory growth in St. Lucia. Generally speaking, the Haricot variety appears to have given better all-round results, but must still be regarded as a poor yielder.

The local and American strains of Lima bean still remain the best; but growers might give more attention to the Canavias (Horse bean, etc.), which in spite of local prejudice may be consumed with perfect safety.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue deals with the importance of properly grading fruits exported from the West Indies.

On page 227 appears an article giving practical hints for packing fruit for export.

Insect Notes, on page 234 describes the life-history of white grubs injurious to sugar-cane in Porto Rico.

On page 237 will be found an article on the importance of securing a supply of pure milk and giving legislative measures in this connexion which have recently been taken in Canada and Antigua.

Agricultural Instruction in Trinidad Elementary Schools.

In his *Annual Report on Elementary Education* in Trinidad in 1916 the Inspector of Schools gives the following particulars as to instruction in agriculture in the schools belonging to his department. The Agricultural Instructors gave instruction, as usual, including remodelling of plots, mulching and practical suggestions at some schools, while suggestions as to the improvement of their gardens were given to the head teachers of all schools visited. In all, there are 224 school gardens in Trinidad and thirty-three in Tobago. As interest in the school shows appeared to be on the wane, an agricultural competition of schools was substituted. Forty prizes were awarded and 181 schools competed. Points were awarded for agricultural knowledge (an oral examination of boys was held), the upkeep of the school garden, the neatness and appearance of the school grounds, nature study experiments, and the value of the school museum and herbarium. The Curator of the Botanic Gardens made a final inspection of the leading schools and he reported he was very pleased at the high standard of efficiency shown in the majority of the schools visited, which were a credit to teachers and pupils.

A scheme by the Acting Director of Agriculture for the reorganization of the present system of teaching agriculture in the schools has been formulated in the report of the Education Commission which has recently been presented.

The school garden as an aid in the teaching of agriculture, as has been wisely remarked by the Director of Elementary Agricultural Education for British Colombia, is as yet imperfectly understood and greatly underestimated. Many teachers still think of it solely as a place where pupils learn to make gardens and grow plants. Parents frequently hold the same view and commend or condemn according as they estimate the value of these very limited services rendered in comparison with the expense involved. On the other hand, the number of teachers and others who recognize the value of the school garden in its numerous educational aspects is daily increasing, and the garden attached to a school is not only regarded as a valuable institution by itself whereby nature-study and agriculture can be taught directly and effectively, but also as a means whereby the teaching of other school subjects can be made more interesting and of greater value to the children.

Education in Grenada.

The study of hygiene and sanitation in the primary schools of Grenada has, as is stated in the *Annual Report* for 1915-16 of the Inspector of Schools of that Colony, greatly assisted the pupils in understanding the aims and immediate object of the ankylostomiasis campaign conducted by the International Health Commission under Dr. A. MacDonald who, on the practical side of the outdoor work, had the assistance of the teachers in the several districts under operation.

The use of the teachers in their spare time was relied on in such matters as taking a census of definite areas, supervising the collection of specimens for examination and the distribution of medicines, visiting the homes of the people to induce them to continue the prescribed treatment and endeavouring to spread a knowledge of the sanitary provisions necessary for the prevention of the disease.

With regard to object-lessons, the Inspector expresses the opinion that the reintroduction of this subject would serve as an excellent diversion from the monotony of the three Rs which are exclusively taught in the Lower Division Schools and would fulfil the twofold purpose of developing observation and training children to express their thoughts in words, a faculty the lack of which largely retards intelligent and ready handling of most subjects of the curriculum.

In technical instruction St. George's Anglican School was conspicuous in having adhered to this subject of the syllabus for which no money grant is paid. The development of intelligence attending this mode of instruction amply produces, it is pertinently noted, a more intelligent study and grasp of other subjects. The work submitted consisted of paper modelling.

Rats and Sparrows.

A memorandum dated April 7, 1917, has been issued by the Food Production Department of the Board of Agriculture in England calling attention to the great increase of rats and house sparrows in many parts of that country, and to the depredations committed upon crops by these pests. As it is most important that every practicable means of conserving the national food supply should be adopted, arrangements for the destruction of the pests have been recommended by the Board, as reported in the *Journal of the Board of Agriculture* of May 1917, as follows: (1) the formation of rat and sparrow clubs; (2) the appointment of a professional rat-catcher at a fixed weekly wage; and (3) the offering of rewards to other persons at rates which should not exceed: 1s. per dozen rats' tails; 3d. per dozen heads of fully fledged house sparrows; 2d. per dozen of unfledged house sparrows; and 1d. per dozen house sparrows' eggs.

Where rewards are offered, great care must, it is advised, be taken to prevent fraud. Competent persons should be appointed who would be responsible for making the payments and for ensuring that the tails, heads and eggs brought in are destroyed, as soon as the reward has been paid, and are not taken away by the payee or by any other person; and they should be authorized to withhold payment and report any case in which there might be reason to suspect fraud.

It has been estimated, as stated in *Nature* for May 3, 1917, that the annual loss to farmers and others in England, caused by house sparrows, amounts to the incredible figure of £8,000,000, while that caused by rats is about £15,000,000.

Transmissibility of Pellagra.

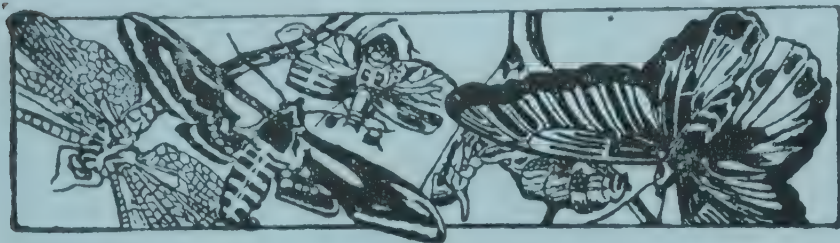
Investigations, reported in the *Experiment Station Record*, Vol. 36. No. 4, as to the transmissibility of pellagra to the human subject have been continued by the public health authorities in the United States. Material (nasopharyngeal secretions and epidermous scales from pellagrous skin lesions) from seventeen severe cases of pellagra was administered to the volunteer subjects of the experiments (sixteen human) who afterwards continued their customary habits of life and diet. The opinion is expressed that these experiments furnish no support for the view that pellagra is a communicable disease but materially strengthen the conclusion that it is a disease essentially of dietary origin, brought about by faulty, probably deficient diet.

'Extension Notes'.

The *Hawaii Agricultural Experiment Station* is publishing a series of Experiment Bulletins designed to fill a field not fully occupied by the two series of bulletins which have been maintained by that Station since its organization. The regular bulletins of the Station give the results of the experiments performed by the scientists at the station and many of these are of a very technical nature. The second series, namely, the Press Bulletins, is concerned principally with the writing up, in a popular manner, some line of experiments or some one topic upon which the station has concluded investigation and is less technical than the first series.

For some time there had been felt a want in the Sandwich Islands for a series of bulletins of even less formal character than the Press Bulletins to afford brief discussions on topics of interest in each issue. The present series, called Extension Notes, will not be confined to reporting the work actually done at the Experiment Station but will contain items of agricultural interest likely to be of practical application to local conditions. The series, it is hoped, will do much towards bringing the extension workers of the department and the actual farmers into closer touch. The difficulties of travelling throughout the islands make it impossible for the agricultural instructors to maintain as close personal contact with the individual planters as is desirable. The series will, therefore, serve to carry messages from the instructors as would be given by word of mouth, were it possible to reach all in that way. By this means the field work of the department will be supplemented and, in addition, the material gathered together be put into permanent form so that it can be kept by all for future reference.

Among the articles contained in the first issue of Extension Notes are the following: Sorehead in Chickens; Lessons from the Country Fairs; the Farmer as a Business Man; Co-operation; and a Superior Sweet Potato. The article on Country Fairs emphasizes the possibility of local development of diversified industries in the islands, especially in the production of food crops for man and forage and feed for live stock, and deals with the difficulties of marketing them promptly and profitably.



INSECT NOTES.

WHITE GRUBS INJURIOUS TO SUGAR-CANE IN PORTO RICO.

In the last number of the *Agricultural News* there was an account of some important investigations which are being carried on by Mr. E. G. Smyth on the five species of May beetles (or hard backs) injurious to sugar-cane in Porto Rico. Some of the habits of these species were dealt with, and some of the methods of rearing white grubs as used by Mr. Smyth were touched upon. The scientific names of the five species were given, four of them under the genus *Phyllophaga* (better known as *Lachnosterna*), and one under the genus *Phytalus*. So far as is known at present, none of the Porto Rican species of these beetles occurs in these islands, although closely related species are found in some of the islands. For instance, *Lachnosterna patruelis* occurs in St. Kitts and Dominica, *L. patens* in St. Vincent, and an unknown species of *Lachnosterna* is a serious pest to sugar-cane in Antigua. The genus *Phytalus* is represented by *P. smithi* in Barbados. The life-history of none of these four species has been studied, and with the exception of *Phytalus smithi* very little is known of their habits. The following details of the life-cycle and habits of *Phyllophaga* (*Lachnosterna*) *vandinei* as worked out by Mr. Smyth in Porto Rico are in their main features typical of the other Porto Rican species of Melolonthids, and are of the great interest as giving an idea of what we may expect to find when a more intensive study of our local species comes to be made.

THE LIFE-CYCLE OF PHYLLOPHAGA (LACHNOSTERNA) VANDINEI.

Mr. Smyth has found that the life-cycle of this species covers, roughly speaking, one year. The average normal egg-to-adult period covers just ten months, the maximum period being thirteen months, and the minimum period seven months. This was calculated from fourteen individuals bred from egg to adult. It was observed that the adult beetle, after issuing from the pupa, may remain underground for a period varying from two weeks to two months. The pre-oviposition period, or the time between the emergence above-ground and the beginning of egg-laying, was not determined in the laboratory as reared specimens refused to oviposit, and it was difficult to ascertain whether specimens caught in the field had just emerged or not. But calculating the pre emergence period to average a month and the pre-oviposition period to require about another month, this beetle is seen to have a life-cycle of virtually one year. Under favourable or adverse conditions this period may be shortened or lengthened considerably.

EGG. The egg of *P. vandinei* is oval, pearly white, and about $\frac{1}{10}$ -inch long. Eggs are laid among the roots in the soil in small globular pits or cavities, the walls of which are cemented or compressed by the ovipositor of the female in such a way that even in dry, sifted soil they remain intact unless subjected to pressure.

LARVA. These eggs hatch in about two weeks on the average, and the young grubs feed almost entirely upon organic

matter in the soil until near the first moult, and then begin to attack roots. The average duration of the first instar was found to be thirty-six days, but favourable or adverse conditions tend to shorten or lengthen this period considerably. The duration of the first as well as the other two instars of the grub were found to be influenced more by the amount of moisture in the soil, and by the presence or absence of mites, fungus or bacterial disease than by the amount of food supplied to the grub.

The average duration of the second instar was found to be forty-seven days, and that of the third instar was 183 days. The length of all the instars was increased by cold and shortened by warm weather, but the grub never ceases to be active, as is the case in the cold winters further north. The average duration of the whole larval stage was 267 days, the maximum being 356 days and the minimum 179 days. This was calculated from fifty larvae of this species reared from egg to pupal stage, and it will be noticed what a great variation there is in the length of the larval stage.

PRE-PUPA. Towards the end of the third instar the grub begins to get sluggish and stops feeding. The body undergoes certain changes in external appearance, becoming yellow, opaque and harder to the touch. The actual pre-pupal stage lasts about a week and then the pre-pupa moults. The average duration of the pupal stage, from twenty-two observations, is three weeks.

ADULT. When the adult first issues from the pupa case its body and wing covers are soft, and the latter are white, but in a few hours the beetle becomes a chestnut-brown, and the whole body gradually hardens. As mentioned above, the beetle spends about a month in its pupal cell, until the first heavy rains have so softened the soil that it can dig its way upward to the surface.

FEEDING OF ADULTS AND ATTRACTION TO LIGHT.

The adult may beetles (or hard backs) do all their feeding at night. They issue from the ground soon after dark and after a short flight lasting from fifteen to twenty minutes they begin feeding. They feed on the leaves of plants and trees, and they are described as voracious eaters, sometimes completely stripping small trees. In Porto Rico damage of this nature seems to be caused by general infestations of a severity so far unknown in these islands. The flamboyant and the casuarina are among the favourite food-plants of these beetles and banana and coco-nut trees are often badly injured by their feeding.

Observations made by Mr. Smyth show that these beetles do not fly long distances but usually hover round the trees near whose bases they hide in their burrows during the day.

As regards their attraction to light, it was found that *Phyllophaga* adults are ordinarily only attracted to light during their flight and before they have settled on foliage to feed. To have any practical efficiency in attracting these beetles (*P. vandinei*) for destruction a light must be close to the ground, and must be started immediately at dusk, while beetles are flying. It need not be run for over an hour after dark, as time after that is wasted.

MATING OVIPOSITION OF FEMALES.

Mating usually takes place between 7 and 8 p.m. in the evening, that is, immediately after the cessation of flight.

Egg-laying takes place underground in the soil near the bases of trees and plants where the young larvae can find the roots. The exact depth has not been determined, but it is probably from 8 to 12 inches, at which depth beetles are usually found in their burrows.

These notes will be continued in the next issue.

J. C. H.

BLOOD-SUCKING FLIES IN GRENADA.

In the *Bulletin of Entomological Research*, London, of January 1917, Dr. A. MacDonald, who was in charge under the International Health Commission of the campaign against ankylostomiasis in Grenada, contributes some important notes on blood-sucking flies in that island. Of the mosquitoes in Grenada it appears that the only Anopheline found has been *Anopheles argyrotarsis*, R.D., a recognized malaria carrier, which has a permanent habitat in the shallow moist flats in the neighbourhood of lagoons and estuarine swamps round the island. Most of these are remote from human habitations, and, as breeding places, should be abolished at little cost. The larva of this mosquito prefer pools on which the sun will shine most of the day, and may be found, tangled in algae, more frequently on the shaded side of a sun-heated pool. They are also found in temporary breeding places, such as wayside gutters, hoof-marks, pig wallows, trenches, and flats in grass land throughout the island in close proximity to human residences. *Stegomyia fasciata*, F., is common in and about the town of St. George's, but is not so numerous in the country districts. It was never found in empty cacao pods, the common breeding place of *Limatus durhami*, and only occasionally in rock holes and once in a wild pine, associated with *Wyeomyia pertinens*. The larvae are devoured by the larvae of *Megarhinus* in captivity and therefore if *Stegomyia* eggs are laid in tree-holes and wild pines frequented by *Megarhinus*, the larvae will probably have little chance of reaching maturity. *Culex fatigans* is found in wayside pools and ditches, especially if they are foul. Filariasis in an acute form is unknown in Grenada. Several patients with morbid conditions diagnosed as filariasis may have acquired the infection elsewhere. *Limatus durhami*, probably the most ubiquitous mosquito in Grenada, occurs at elevations of 400 feet up to 2,300 feet. Its larvae are found in old cacao pods, in fallen palm leaf petioles, and in the flower spathes of palms. The adult in nature bites in the day-time. *Haemagogus splendens*, Will., is well distributed throughout the wooded parts of the island, except near the sea. One larva was obtained from a tree-hole. The avocado or alligator pear (*Persea gratissima*) most commonly provides holes in which mosquito larvae may be found. *Wyeomyia grenadenis*, Edw., comes into houses after dark, as does also *W. pertinens*, Will., which breeds in tree-holes and wild pines. *Culex similis*, Theo., *Deinocerites cancer*, Theo., *Janthinosoma posticata*, Wied., and *Culex infictus*, Theo., were found in roadside gutters. The last-named species may be caught in houses after dark, and probably breeds in tree-holes and wild pines. *Janthinosoma neoapicalis*, Theo., was found associated with *Anopheles argyrotarsis*, as also was *Culex annulatus*. *Stegomyia buscki*, Coq., was found in a collection of water in the petiole of a fallen palm leaf at an elevation of 2,600 feet, and in a cacao pod at the upper limits of cultivation. Larvae and pupae of an unidentified *Aedes*, probably a new species, were collected from a tree-hole and from a pine in a cacao plantation. The larvae of *Megarhinus haitiensis*, D. and K., were also found in wild pines and tree-holes, and fed readily on *Stegomyia* larvae in captivity. *Culex (Micraëdes) conservator*, D. and K., was found with *Corethrella appendiculata*, Grab., in similar breeding places, and a *Culex* allied to *elevator*, D. and K., was bred from a wayside pool. The swamp mosquito of Grenada is *Ochlerotatus niger*, Giles; it remains in deep shade during bright sunshine, and emerges about an hour before sunset, at which time it will bite as well as at night. *Deinocerites cancer*, Theo., also breeds in brackish water.

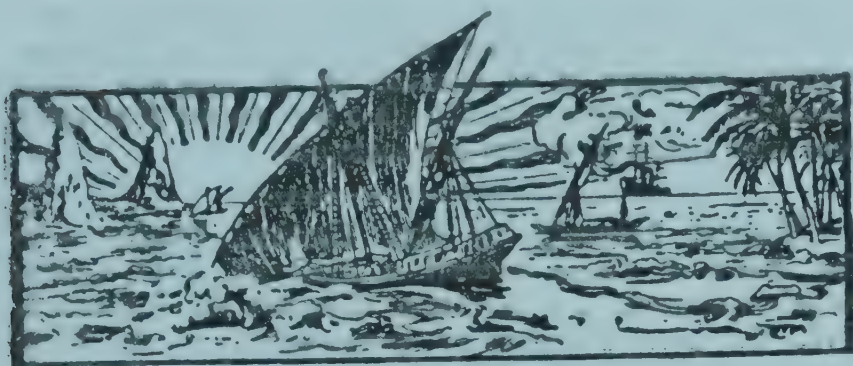
The sandfly of Grenada which is a species of *Ceratopogon*, is practically ubiquitous and causes considerable annoyance, though no disease is known to be carried by it.

Its control is difficult, as 16-mesh netting will not keep it out. Of the blood-sucking flies which attack domestic animals, *Stomoxys* is as common as in England, while *Tabanidae* are uncommon, though a few unidentified specimens were captured, always in remote places.

Virgin Islands of the United States.—In *The Board of Trade Journal* of April 26, 1917, appear the principal sections of the Act of Congress dated March 3, 1917, 'to provide temporary government for the West Indian islands acquired by the United States from Denmark by the Convention entered into between the said countries on August 4, 1916 and ratified by the senate of the United States on September 7, 1916, and for other purposes.' Section 3 of the Act provides that on and after the passage of the Act there shall be levied, collected and paid upon all articles imported coming into the United States or its possessions from the West Indian islands ceded to the United States by Denmark, the rates of duty and internal-revenue taxes that are required to be levied and paid upon like articles imported from foreign countries. It is provided, however, that all articles the growth or product of, or manufactured in such Islands from materials the growth or product of such Islands or of the United States, or of both, or which do not contain foreign material to the value of more than 20 per cent. of their total value upon which no drawback of Custom duties has been allowed therein coming into the United States from such Islands shall be admitted free of duty. By section 4, it is stated that until Congress shall otherwise provide, all laws now imposing taxes in these West Indian islands, including the custom laws and regulations shall, in so far as compatible with the changed sovereignty and not otherwise provided in the Act, continue in force and effect, except that articles the growth, product or manufacture of the United States shall be admitted there free of duty. It is provided, however, that upon the exportation of sugar to any foreign country, or the shipment thereof to the United States or any of its possessions, there shall be levied, collected and paid thereon an export duty of \$8.00 per ton (of 2,000 lb.) irrespective of polariscope test, in lieu of any export duty that formerly was required by law. Under the United States non-preferential tariff sugar of 96° pays \$1.256 per 100 lb. and the St. Croix export duty is 40c. per 100 lb.

Indian Runner Ducks.—It is admittedly uneconomical to continue to breed and feed chickens for table purposes under present conditions, and, as a matter of fact, breeders in Great Britain have been officially recommended to discontinue this branch of production while feeding stuffs are in such short supply. It must therefore be obvious that arguments which apply to fowls are also applicable to ducks, and, in view of the general recommendation to concentrate on egg production, those who are favourably situated for the purpose are advised by *The Field* of May 26, 1917, to consider in this connexion the claims of the Indian Runner.

The Indian Runner duck is essentially a layer, and, in consequence, is only of secondary consideration as a table bird. As a layer, the Indian Runner is capable of such prolificness that it has been described as a Leghorn among ducks. Its great activity as a forager not only very materially reduces the demands upon the food supply, but makes it extremely useful in effecting a considerable reduction in insect pests, while, probably owing to its distinctive foraging habits, the eggs are of a much more delicate flavour than those of other breeds of ducks.



GLEANINGS.

In the *West India Committee Circular* of April 19, 1917, the correspondent in Tobago writes that a proprietor of that island has imported a motor lorry for the conveyance of his produce, supplies, etc., and that no doubt more of these will be in use there before long.

The sugar industry in Mauritius had, according to the *Louisiana Planter* of May 26, 1917, twenty-eight factories in operation during the past season. The normal juice extracted was 80 per cent maximum and 71.70 per cent minimum. The average hours of daily work for the mills was 22.3 maximum and thirteen hours minimum.

According to the Board of Trade Statistics, quoted by the *Produce Market Review* of April 7, 1917, the average increase in the price of bread in the United Kingdom since the beginning of the war was, up to November last, 65 per cent., and having regard to the further advance since then, the present price shows an increase of slightly more than 100 per cent.

In 1915 Jamaica imported rice to the value of £105,998. As pointed out by the Agricultural Instructor for South Westmoreland and Hanover in the *Journal of the Jamaica Agricultural Society*, Vol. XXI, No. 1, the industry is capable of great development, and, if the rice were cultivated to its fullest extent, there would not be the need for this large importation.

In the *Dominica Chronicle* of July 4, 1917, the total value of the exports from Dominica in 1916 is given as £212,310. To this amount the following items contributed as under: lime juice, raw, £50,452; lime juice, concentrated, £44,855; fresh limes, £47,852; essential oils, £20,662; cacao, £17,151; citrate of lime, £9,244; coco-nuts, £1,275; bay leaves, £359; and vanilla, £48.

A series of experiments as to the food value of the maize kernel, as described in *Experiment Station Record*, Vol. 36, No. 4, tend to show that it was necessary to make salt additions to rations deriving their inorganic content from maize before growth could take place, and that it is not easy, if at all possible, to make up a satisfactory ration wholly derived from the corn kernel and its parts.

The *West India Committee Circular* of June 24, 1917, reproduces useful methods for the destruction of cockroaches recommended by the *Lancet*. For actual, quick destruction, stoving with bromine or sulphur dioxide is apparently best; but for domestic application powdered sodium fluoride which has the effect of effectually driving away the cockroach and which at the same time keeps indefinitely, is recommended.

The Field of June 16, 1917, contains a recipe for ginger beer. To 10 gallons of water put 10 lb. best loaf sugar and 8 oz. of bruised ginger (unbleached the best). Boil for one hour and put it into a barrel with 1 oz. hops and 4 spoonfuls of yeast. Let it stand for three days, then close the barrel, putting in 1 oz. of isinglass. In a week it is ready for use. It is an improvement to bottle it after being in the barrel the week.

The production of beet sugar in Russia in 1915-16 is given in the *Louisiana Planter* of May 19, 1915, at £1,640,000 short tons with about 212,000 tons left over from the previous crop. The requirements of Russia are under normal conditions estimated at 1,850,000 tons. At the termination of the war, Russia bids to be one of the largest sugar producers in the world, outside of Cuba and British East India.

During the season for September 1, 1915 to August 31, 1916, the total output of ginned cotton in Egypt as given in *The Board of Trade Journal* of May 24, 1917, was estimated at 6,020,400 cantars (cantar=99.05 lb.) as against an actual output of 4,774,770 cantars in the previous season, while in the calendar year 1916, 5,416,936 cantars of ginned cotton were exported from Egypt as compared with 6,899,132 cantars in the previous year.

Invaluable work is, as is shown in the report for the six months ended December 31, 1916, being done by the Committee of the West Indian Contingent Committee in providing comforts for the battalions of the British West Indies Regiment and in assisting the men in many other ways. The Committee is also authorized to act as a central authority for the control and distribution of dutiable gifts to men from the West Indies serving in British regiments stationed in England.

A proclamation dated June 8, and published in the *St. Lucia Gazette* of June 9, 1917, prohibits under the Customs (Exportation Prohibition and Restriction) Ordinance 1916, the exportation from St. Lucia of all kinds and every kind of (a) animals used for food and (b) foodstuffs whether raw or manufactured except fresh fruit and such articles, including ships' stores, as may be exported with the permission of the Treasurer and upon such terms and conditions as the Treasurer may direct.

In the *Annual Report* of the North Western District of British Guiana for 1916 it appears that an additional area of 88 acres of coffee consisting principally of the Liberian species was put under cultivation. The crop of coffee in the district has increased from 69 acres in 1911 to 639 acres in 1916. The farmers are experiencing difficulties in the picking through scarcity of labour, and in the curing for the want of proper machinery. The average price for the local grown coffee in Georgetown was 10½c. per lb.

If the food they are attacking can be shut up or placed beyond their reach, mice can, as is advised in the *Agricultural Gazette of New South Wales* of May 1917, be poisoned with strychnine mixed with flour and placed in suitable vessels such as saucers. Out in the open a kerosene tin half full of water with the top cut off, sunk level with the ground, makes an effective trap when placed where mice are congregating, and where mice are not so numerous, an attractive bait placed on the bottom of the tin (no water being left in the tin) will often catch great numbers.

SUPPLY OF PURE MILK.

Of late years it has been fully recognized that certain diseases are disseminated through milk, and, in the case of bovine tuberculosis, this fact was clearly stated in the final report of the Departmental Committee on tuberculosis appointed in Great Britain in 1912. The Committee expressed the opinion that the bacillus of bovine tuberculosis was the cause of tuberculosis in man, and to a greater extent in children, and that the best way to attain security from this danger was entirely to eradicate tuberculosis from the cattle of the country, and welcomed the proposed legislation dealing with the question of milk supply. About this time, too, the Tuberculosis Conference was held in Trinidad, and, at the conclusion of the discussion on the paper read by the Veterinary Surgeon of the Imperial Department of Agriculture, a resolution was passed urging that measures should be taken to prevent the extension in the West Indies of bovine tuberculosis and the possible infection of human subjects. Since the Conference, general measures to this end do not appear to have been taken by the colonies represented, but it is satisfactory to know that the municipal authorities of St. John's, Antigua, are alive to the danger and have recently amended the by-law in respect of milk to make it more effective to secure a wholesome supply for the city.

In the *Leeward Islands Gazette* of June 7, 1917, appears the by-law (No. 1 of 1917) passed by the City Commissioners. After defining the terms 'messenger', 'huckster', 'vendor' and 'Agent of the Commissioners', the terms 'impure', 'unwholesome' or 'adulterated' are applied to: (a) milk containing less than 3 per cent. of milk fat; (b) milk containing less than 8.5 of milk solids other than milk fat; (c) milk in any stage of putrefaction or having any abnormal colour, consistency or smell; (d) milk which has been diluted with water or other fluid, or to which any foreign substance whatever has been added; (e) milk drawn from cows within twenty days before or ten days after parturition; (f) milk drawn from any diseased cow; and (g) milk which has been produced under insanitary conditions, or which has become contaminated by contact with any unclean substance or by being handled by any sick or unclean person.

Every vendor of milk must obtain a licence, and no person can receive a licence unless the milk is produced and handled under sanitary conditions, and unless he furnishes a certificate from the Government Veterinary Surgeon that each cow from which he obtains his supply of milk is free from tuberculosis or other dangerous disease. Licence holders are compelled to notify to the City Commissioners the existence of any disease among his cows, or among any members of his family or milk attendants or messengers; and no person suffering from a communicable disease or who has recently been in contact with persons so suffering will be permitted to handle milk or milk utensils for the supply of the city. The milk must be conveyed in locked cans to the vendors and hucksters must keep their milk in locked cans fitted with a draw-off tap from which only the milk may be dispensed. Among other salutary regulations under this important by-law are that milk for sale shall be kept in clean and suitable receptacles and screened or protected from dust and flies, that milk shall not be kept or sold in rooms used wholly or in part for domestic or sleeping purposes, and that any room in which milk is kept for sale must be clean and not frequented by persons suffering from any diseases or by domestic animals and must not be in communication with a latrine or urinal.

In connexion with the important subject of a pure milk supply the Government of Canada has recently passed

regulations relating to bovine tuberculosis. Under these regulations the Government will assist any town which signifies to the Veterinary Director General its desire to have the aid of the Department of Agriculture in controlling tuberculosis in the cows supplying milk to the town, provided the town will undertake that: (a) dairies in which milk is produced for sale shall be licensed; (b) no licence shall be issued unless the dairy conforms with the required standard; (c) the standard shall require that the stable shall have an ample amount of air space and shall be well ventilated, drained and kept clean and sanitary; (d) two years from the date of the first test of the cattle of a dairy, the sale within the town of unpasteurized milk shall be prohibited, unless the veterinary inspector can certify that the herd contains no reactors and is free from tuberculosis; and (e) an inspector shall be appointed by the town whose duty it will be to see the provisions of the regulations duly carried out. Following an examination, cows affected with open tuberculosis, which are distributing the germs of the disease through the milk, faeces or sputum, will be slaughtered as soon as possible, while reactors (suspicious animals being classed as reactors) will be disposed of by immediate slaughter or slaughter after they have been prepared for the block by drying off and feeding or retaining in the herd and selling no milk until it has been pasteurized. Compensation for cows slaughtered will be given at the rate of one-half of the appraised value of the cow, if destroyed as a case of open tuberculosis, and two-thirds of the appraised value, if destroyed as a reactor at the request of the owner. No compensation will be paid to an owner, unless he assists as far as possible in the eradication of the disease by following the instructions of the Inspector as to disinfection, etc. To facilitate the operation of the regulations, the dairies in any town may be divided into two classes, namely, raw milk dairies, and pasteurized milk dairies. Following the principle laid down by the International Health Commission in leaving to local authorities the carrying on of its work after ankylostomiasis has been practically eradicated from a district by the officers of the Commission, whenever, in the opinion of the Veterinary Director General the work of eliminating tuberculosis from the herds supplying a municipality has reached a satisfactory point, he may notify the Medical Officer of Health that the Department of Agriculture has terminated its work in that locality and thereafter the municipality will be expected to maintain the standard reached.

In the West Indies, although the danger to which public health is exposed through the use of milk from tuberculous cows is very great, it is unfortunately only one among many dangers to which persons are exposed through the use of impure, infected and dirty milk, and, as it is more than likely that the excessive mortality among children in these islands is due to no other cause than the use of impure milk, the subject is one which should engage the serious attention of local authorities.

The *Times* of India states that great progress has been made in Hyderabad in manufacturing motor spirit from the mahua or mhowra tree. About 25,000 tons of the flowers are gathered every year, of which only 10,000 tons are used for liquor, leaving 15,000 tons as a drug in the market. Motor cars have been run successfully on a spirit prepared from mahua at half the cost of petrol. The annual local consumption is about 100,000 gallons and only 15,000 tons of mahua are required to make that quantity.



THE INDIA RUBBER INDUSTRY.

The advent of the plantation industry has added a great responsibility to the British Empire, which now virtually controls the raw rubber of the world. Our Empire produces thrice the total quantity of rubber derived from the whole of the African and American continents, and the fact that this year's plantation crop is valued, on present prices, at no less than £55,000,000, is sufficient evidence of the extent of our added responsibility. The experience gained in 1916 should help those engaged in the industry to make better use of this national asset and to encourage them to apply this product on every possible occasion. No opportunity of making advances in method and scope of rubber manufacture in British factories, and in the production and marketing of the plantation product should be omitted.

Although every section of the industry has been seriously affected in consequence of the war, the past year has been one of success all round. The general trade has severely felt the depletion of their staffs. Machinery makers have had to come under the Munitions Act, and it has been with the greatest difficulty that any of them have been able to execute orders of any consequence either to plantation companies or to manufacturers in this country.

In the annual review of the industry for 1916 contained in the *India Rubber Journal* of January 6, 1917, it is shown that, while the war has led to an increase in the use of certain lines of manufactured goods, such as tyres, rubber boots, hose, trench caps, waterproofing and surgical sheeting, etc. many other lines have, on the other hand, fallen considerably. The petrol restrictions have incidentally affected tyre consumption, and the declaration of lists of contraband has made trade difficult in many ways.

The net result of all the legislation and the depletion of staff has been that the manufacturers in Great Britain have had to put a check on their production, consumption in private life of rubber articles has been diminished, and the manufacture of types of machinery and all forms of manufactured rubber has been stimulated in the United States. The rubber coming from plantations and Brazil has all found a welcome home, but the increased production of manufactured materials is to be seen more in the United States than in any other country.

At present, in order to encourage the importation into the United States of the raw rubber, the proposed 10 per cent. ad valorem tax on crude rubber was struck out of the War Revenue Bill recently before Congress. The Chairman of the Rubber Committee of the Council of National Defence emphasized the seriousness of the present crude rubber situation by pointing out that, whereas, in normal times, there is three months' supply of rubber at the mills, at present there was only thirty days' supply, with seventeen days' supply in transit and twenty-nine days' supply permitted at ports of origin.

It is some satisfaction to know that the rubber industry has fulfilled functions during the war which were never contemplated. Its use has been a pronounced success in directions only understood by those who have for months on end lived in trenches and successfully withstood the effects of rain, frost and gas. Millions of rubber appliances have been used during the year to withstand the effects of gas attacks alone.

As a fair indication of the speculative character of the raw rubber market, it may be stated that, whereas in January the price was 4s. 4d. per lb., there was a decline all the way until August, the bottom price being 2s. 1½d., that is a fluctuation of 100 per cent. The average prices published in the annual reports of the various plantation companies have rarely indicated an average of much beyond 2s. 9d.

The cost of freight for rubber from Eastern ports showed a large increase, but much below that for tea. Tea had to pay about 3d. per lb. from Ceylon to Great Britain, whereas rubber never cost more than 1½d. per lb. Insurance rates did not decline, but it can hardly be said they were excessive. The total increase in cost of freight and insurance due to the war has averaged a little over 2d. per lb. of rubber.

In dealing with the subject of diseases and pests, the review wisely considers that no expense can be too great in instituting research which will enable all concerned in the industry to tackle each disease as soon as it appears. It is felt that the few scientific officers at present employed are asked to give up their time entirely to sheer routine work instead of to research investigation devoted to the attempt to eradicate the diseases at present known. There is no longer any excuse for planting organizations to refuse to provide the scientific equipment on the score of having no properly equipped imperial laboratory where men for such research can be trained. The Imperial College of Science and Technology, South Kensington, has established a mycological department equal to any in Germany prior to the war. Instead of being compelled to send mycologists in training to other countries to complete their education, we have the means at our command to finish off their training and to give them the best possible equipment for service in the tropics.

PRIZE HOLDINGS COMPETITIONS IN GRENADA AND CARRIACOU.

Competitions, the judging of which will take place between September and January next, for cotton in Carriacou and for provisions and cacao in Grenada, have been announced, and the particulars of the different competitions have been made known by means of circulars distributed among the small owners likely to compete.

In the cotton holdings competition, which is limited to peasant proprietors of not more than 5 acres of land, prizes, ranging from 10s. to £3 10s. and amounting in all to £20, will be awarded for improvement in the cultivation of cotton in Carriacou. The competition is divided into two classes, the first for owners of 3 to 5 acres of land who must cultivate not less than 1 acre, and the second for owners of less than 3 acres with not less than ½-acre under cotton cultivation. Among the conditions laid down are that the land must be forked and drained before May 31, 1917, and must be planted with cotton seed supplied, free, by the Agricultural Department. In judging, the following points will be considered and the following marks awarded: forking, 40 marks; draining, 20 marks; manuring, regularity of planting and spacing, number of plants in a hole and general condition of the lot, 10 marks each.

The competition for the best provision gardens in such parishes of Grenada as may be fixed by the Agricultural Society will be restricted to peasants owning or leasing not more than 10 acres of land, and the prizes will be allotted in two classes, the one being confined to 1 acre or more of mixed provision crops, the other to ¼-acre or more planted exclusively in either yams, tannias, eddoes, beans or peas, except pigeon peas. The prizes for the two classes amount to £18, and range from £2 to £4.

The third competition is to encourage the improvement of the cultivation of cacao among small owners in Grenada. Only peasant proprietors holding not more than 10 acres of land of which not more than 5 acres are cultivated in cacao are allowed to compete. The prizes to be allotted are in 3 classes: class I, 3 acres and not exceeding 5 acres; class II, $1\frac{1}{2}$ acres and not exceeding 3 acres; class III, $\frac{1}{2}$ -acre and not exceeding $1\frac{1}{2}$ acres, and amount to £26, ranging from £1 10s. to £5. Competitors who had not commenced work by May 31, 1916, will be disqualified. In judging, the following points will be considered and the following maximum marks awarded: draining, 35; tilth or tillage, 15; bedding, mulching or panning, 15; pruning, 10; weeding or cleanliness of the field, 10; general condition of the holding, 10; and the manner in which the pods are reaped, 5.

AGRICULTURE IN BARBADOS.

The change in the weather which took place on June 20 has been a permanent one, and the result has been the conversion of the face of the island into a sheet of livid green. The weather for July could not have been more favourable. We have had showers or rains practically every day up to the present time and, except in some districts in the parishes of St. Lucy and St. Peter, there has been no heavy rain to cause damage by way of 'wash'. Over certain parts of these parishes there was a very heavy rain during the twenty-four hours ending 6 a.m. On the 7th instant, some gauges measured nearly 6 inches. Over a limited area, roads and fields suffered as a result of this downpour, but, elsewhere, nothing could have been more satisfactory than the way the rain has fallen for the first half of the current month. In no parish has the record been under 4 inches, while the average will be somewhat over 5 inches for the fifteen days. In spite of the severe drought through which the island passed during the earlier months of the year, the rainfall to the end of June is practically the same as that recorded for the first half of last year.

Several of the factories are still boiling second quality sugar, and, in some instances, it will be a few weeks before they will be able to make up the figures of this year's output. Doubtless, with the progress of sugar chemistry, this work will grow less and the major part of the molasses will be consumed in first quality crystals. In most of our factories, the best result from the 'working back' of second quality sugar cannot at present be obtained because of the lack of vacuum-pan power. In some instances, one pan has to do all the work at great inconvenience and at some loss. It was asked at an earlier stage of our factory system what would be done with the refuse molasses, but it will very soon be found that, with further improvements, the supply of this molasses will not exceed our need for refining purposes, and for stock feed.

The tillage for the crop of 1919 is in full swing, and already some estates have dug one-third of their cane-holes. This progress is most satisfactory. In some instances labour is not sufficient, but we have heard but little complaint. Sheep manure is being liberally and extensively applied to the fields now under preparation. Apart from its other fertilizing properties, this manure is the only form in which potash can at the present time be obtained.

The statutory area to be put under ground provisions has almost been planted. Many estates have already fulfilled their contract, and we are sure that, by the end of July, every plantation will have done so. In St. Lucy's parish some difficulty has been experienced in obtaining slips

for planting. There are a few fields of potatoes, planted during the middle of March, which are nearly ready for market, and those planted with the rains in April are making excellent progress. We predict that potatoes will be very plentiful towards the end of the year. The Governor-in-Executive Committee has, by an *Extraordinary Gazette*, notified that sweet potatoes shall not be retailed at a dearer rate than 5 lb. for 10c. and that the price in the field must be fixed so as to enable hucksters to purchase at a price not exceeding $1\frac{1}{4}$ c. per lb.

Sugar is being quoted at \$4.50 per 100 lb. for both muscovado and crystals. The molasses market is now closed as the entire crop has been sold. (*Agricultural Reporter*, July 14, 1917.)

AGRICULTURE IN NIGERIA.

After three comparatively dry seasons, normal rains well distributed throughout Nigeria resulted in increased yields from both permanent and annual crops, and although, as is shown in the *Colonial Report* of that Colony, the only increase in 1915 as compared with 1914 of importance in the exports was that of cacao. In the Southern Provinces the efforts made to develop the cacao industry are beginning to bear fruit, and to foster this cultivation in the Benin district thirty-two sites for plantations were selected and the owners were shown how to lay them out. Increased attention was given to the instruction of farmers in the preparation of this product, curing demonstrations being given at several centres. Merchants again assisted this work by paying a higher price for cacao cured under the auspices of the Department of Agriculture. Very favourable opinions have been expressed by brokers and cacao and chocolate manufacturers as to the quality both of the machine-dried and sun-dried products, but the latter product is considered to be superior. It is fortunate that in Nigeria the principal cacao harvest coincides with the dry seasons, where it is rarely necessary to resort to artificial means to cure the crop. To encourage farmers to lay out their farms in a proper manner, a planting competition was organized. Prizes were offered for the best farms of 250 cacao trees provided with the necessary shade trees. The requisite plants were supplied by the Department and agricultural officers assisted the competitors by selecting suitable sites and explaining the objects and conditions of the competition. In the Northern Provinces ground nuts have been purchased at Kano on a scale surpassing all previous years and the limit of output is not yet in sight, although the purchasing power of trading firms was seriously hampered by lack of shipping facilities. The work started at the Maigana Experimental Station in 1913 with the object of raising an improved type of cotton seed, has met with considerable success and the prospects of cotton growing in the district have never been brighter. One of the exotic introductions which has met with great local favour is sugar-cane. Five varieties of pedigree seedling canes were obtained from Barbados in 1914, and three of these, now in cultivation on native plantations, are highly esteemed, not only on account of their superior size but also because of the relative richness of their juice as compared with that of the indigenous variety. Choice fruit trees were also imported from the West Indies and are being successfully propagated by budding and grafting. These will supply a long-felt want in the Northern Provinces, where hitherto fruit has been most difficult to obtain.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
June 14, 1917.

ARROWROOT—5d. to 6½d.
BALATA—Block, 3/ to 3/1; Sheet, 3/11 to 3/11½.
BEESWAX—No quotations.
CACAO—Trinidad, 86/-; Grenada, 68/- to 82/6; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£45 15s. to £46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, £41 per ton; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, 90/- to 110/-.
HONEY—Jamaica, 75s. to 105s.
ISINGLASS—No quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—3½d.
RUBBER—Para, fine hard, 3/1; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, 5/8 to 5/9.

New York.—Messrs GILLESPIE BROS. & Co., July
3, 1917.

CACAO—Caracas, 12½c. to 12¾c.; Grenada, 12c. to 12¼c.; Trinidad, 11¾c. to 12c.; Jamaica, 10½c. to 11¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$42.00 to \$43.00; culls, \$24.00 to \$25.00.
COFFEE—Jamaica, 9¾c. to 11½c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 80c.; Antigua and Barbados, 70c. to 80c.; St. Thomas and St. Kitts, 65c. to 75c. per lb.
GRAPE FRUIT—Jamaica, \$2.00 to \$2.50.
LIMES—\$6.50 to \$7.50.
MACE—39c. to 43c. per lb.
NUTMEGS—20c. to 21c.
ORANGES—\$1.75 to \$2.75.
PIMENTO—6½c. per lb.
SUGAR—Centrifugals, 96°, 6.52c; Muscovados, 89°, 5.66c.; Molasses, 89°, 5.50c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., June 22,
1917

CACAO—Venezuelan, \$11.80; Trinidad, \$11.25 to \$11.75.
COCO-NUT OIL—\$1.12 per Imperial gallon.
COFFEE—Venezuelan, 10c. to 12c.
COPRA—No quotations.
DHAL—No quotations.
ONIONS—\$4.50 per 100 lb.
PEAS, SPLIT—\$10.00 per bag.
POTATOES—English, \$5.75 per 100 lb.
RICE—Yellow, \$9.50 to \$10.00; White, \$6.75 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., July 9,
1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$12.00 per 100 lb.
COCO-NUTS—\$26.40 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$5.00.
PEAS, SPLIT—\$12.00; Canada, no quotations.
POTATOES—No quotations.
RICE—Ballam, \$10.00 to \$10.50; Patna, no quotations; Rangoor, no quotations.
SUGAR—Muscovado centrifugals, \$4.50 to \$5.00.

British Guiana.—Messrs. WIETING & RICHTER; Messrs.
SANDBACH, PARKER & Co.

ARTICLES.	MESSRS. WIETING & RICHTER.	MESSRS. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



A FORTNIGHTLY REVIEW

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Flies.

EVERY year as the trade winds die off and the sugar crop comes to an end, the annoyance caused by flies in West Indian houses, as well as the danger of infection from those diseases in which the fly acts as the mechanical transporter of an infective agent, is appreciably increased. In the same manner as bees are of inestimable service to man in aiding in the fertilization of plants, so flies, on the other hand, being instrumental in the dissemination of disease, become a standing menace to public health.

Pasteur discovered that many diseases are caused by the presence in the blood of tiny living creatures, far too small to be seen by the eye, called bacteria, and since his discovery many kinds of such creatures have been observed and classified so that they can readily be recognized under microscopic examination. After some years it was further discovered that these tiny creatures are carried about by insects of several kinds, and, during the South African war, when enteric or typhoid fever wrought such havoc among the British troops that it has been estimated that more soldiers succumbed to disease than bullets, it was discovered that the germs of this disease, the tiny blood invaders causing it, were transmitted by ordinary house-flies which carry them sticking to their legs and bodies. In the present Mesopotamia campaign flies have played a rôle equally sinister, with such dire results that a commission of entomological experts, including Professor H. Maxwell-Lefroy, was sent out last year to report on the best methods for their destruction.

Careful investigation has proved that flies, bred in garbage teeming with the germs of disease, cover themselves with filth which they carry about and drop on such articles of food as they touch, thus transmitting typhoid, cholera, tuberculosis and ophthalmia, and perhaps diphtheria and smallpox. They are especially active in spreading enteritis by milk pollution. Although the general rate of mortality has, in most countries, thanks to improved sanitation and advances in medical science, steadily decreased during the last generation, infants under one year of age, who are largely dependent on milk or liquid food, have not shared in the benefit. From the first to the fourth month of

the first year of life, gastro-intestinal diseases increase in destructive power, which, in a large measure, is due to contaminated milk and improper methods of feeding. The consequent enormous loss of life is of grave concern to the West Indies, the development of many of the islands being retarded by an insufficient labour supply. The best manner to solve this problem is to reduce the ravages of disease, especially when it can be controlled effectively by personal and combined action.

Many deaths caused by the transmission of germs by flies are preventible by the expedient of so reducing the prevalence of the fly as to render it unimportant as a factor in causing disease. Experience has, however, shown again and again, that it is useless to expect to meet this problem successfully by attempting to kill individual flies, as will be readily understood from a study of the life-history of the fly. The egg of a fly, laid in garbage, hatches in a few hours under favourable conditions into a grub, which in five days turns into a chrysalis, and in another five days the fly appears. One female fly will lay one hundred and twenty eggs at a sitting and in a few weeks can have millions of descendants. As the extermination of flies by individual destruction is out of the question and as flies are essentially the product of filth and dirt, the most effective mode, therefore, of dealing with them is the removal of the sources necessary to their existence.

In towns supplied with pipe-borne water and with a proper sewerage system, typhoid fever should, if the sanitary authorities are alive to the importance of their duties, be derivable solely from outside causes, such as contaminated milk from the country, the return of persons from less sanitary districts, and lack of care in the disposal of the sources of infection from those who have contracted typhoid fever from the first two causes. Although several West Indian towns have sewerage system and most have the tap system for their water-supply, the inhabitants of the islands may be regarded as living strictly under agricultural conditions. The danger of the germs of the disease being conveyed to food supplies by flies is manifest, when it is considered how many favourable breeding places they can find in manure heaps and stables, besides having ample opportunities for development in the defective sanitary arrangements of many houses.

With regard to manure heaps, precautions should be taken to prevent their existence longer than is absolutely necessary. As much as possible they should be removed far away from dwellings or they should be covered with a few inches of earth or sprinkled with some antiseptic solution. There is no gain to the planter to allow pen manure to be exposed to the atmos-

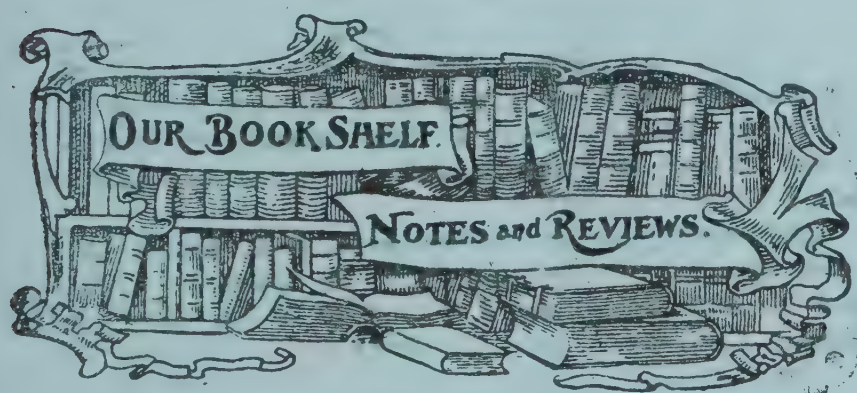
phere. On many estates the manure is allowed to lie about until a very large part of it is lost. It is calculated that exposure to the air results in a short time in a loss of half its value. Cleanliness in the stables is also a large factor in the health of horses and consequently in their working efficiency. Were systematic measures taken in the West Indies to remove, as far as practicable, these fertile breeding places, the number of flies would be sensibly diminished, and the result would add not only to the comfort but also definitely to the health and safety of their inhabitants.

It is naturally out of the question to suppose that flies will be entirely exterminated by the partial removal of their breeding places on estates, and efforts must therefore be made by every person to keep houses and yards scrupulously clean. Dust receptacles should be emptied regularly and no refuse should be allowed to lie about, while it is important to screen food supplies so as not to attract flies. In cases of sickness, stringent precautions should be taken to disinfect all deposits. Fly-poisons for out-door and indoor use (especially in hospitals) are frequently necessary. In Mesopotamia, the method of poisoning flies by exposure of sodium arsenite with sugar yielded good results, and in hot climates where flies come readily to sugar solutions, their use as an outside poison is especially effective. As however, there are obvious disadvantages, owing to their poisonous properties, in using arsenic solutions, important investigations, the results of which will shortly be made known, are being conducted at the Imperial College of Science and Technology of London to find substitutes equally serviceable. So far as laboratory tests can help, these show that there are substances other than arsenic which can kill flies. Fluorides and iodates, used at 1 per cent. in sugar solution and not in any way dangerous or offensive, have been proved to be excellent for indoor use. In hospitals, particularly, the small quantity required makes even the salicylates possible as useful fly poisons, an ounce of salicylate to five pints of water poisoning flies for some time throughout even large hospitals. The fluorides are in use as indoor fly-poisons in the Imperial College of Science, where they destroy successfully flies that escape to the lavatories from the fly rooms.

The dangers from flies are too obvious to be disregarded. Medical men are convinced that general measures, combined with individual effort, against flies would result in a great reduction of disease and mortality. The effort is, therefore, well worth making, and it will be made if the people of these islands come to realize the danger and take the measures necessary to

combat the evil. A clear understanding of the subject should be given to the children of all schools by lessons in the life-history of the fly, and the Boy and Girl Scouts could undertake a supremely useful piece of work by tracking down the breeding places and reporting their existence to the health authorities.

The importance of combating the evil may be briefly summed up. The future development of most of the West Indies depends upon increase in their populations. Disease, especially among infants, is an important factor in retarding the growth of population. Flies are active agents in disseminating disease.



DAIRY FARMING. By C. H. Eckles, D.Sc., and G. T. Warren, Ph.D. New York: *The Macmillan Company*, 1916. Pp. 309.

This is the first of a series of books to be known as the Farm Series which is being prepared to give briefly, but without being superficial, the basic principles whereon may be grounded the scientific study of agriculture in its various branches. The aim of each book will be to discuss the phases of its subject that are most important to the farmer; that is, to answer the farmer's questions and to make these answers in the form of underlying principles rather than as rules.

It is fitting that the first book of the series should deal with what is probably becoming the most important source of revenue of American farmers, who once kept beef cattle but are changing to dairying, and for such farmers a study of the subject with which the book under review deals is of vital importance. The position and experience of the two writers, Dr. Eckles, being the professor of dairy husbandry at the University of Missouri, and Dr. Warren, the professor of Farm Management at Cornell University, enable them to write with authority on the different matters connected with the subjects treated by them in this work.

After indicating the importance of the dairy industry in the United States, the book contains twelve chapters on different subjects connected with cattle and with milk and its by-products, as, for instance, breeds of cattle; selection, improvement, management and feeding of cattle; common ailments of cattle; milk and its by-products, butter and cheese; systems of farming on dairy farms, and other important factors making for success in dairy keeping.

Although there is no established dairy industry on a large scale in the West Indian islands, some of the chapters (particularly those with regard to the selection of breeds) of this book will be of great value to planters and others who keep cows, for the advice it contains is at once practical and concise on all the points it discusses.

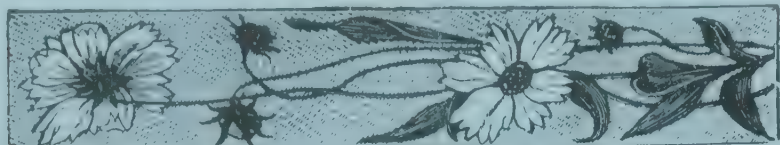
In comparing the value of the different breeds which have been developed for dairy purposes, the chapter on selection states that, while the strong points of Holsteins are high milk yield, marked vigour of constitution, quiet disposition, good feeding qualities, and value for beef and veal, their weakest point is considered to be the low percentage of fat in the yield of milk. On the other hand, Jersey cows rank low as producers of meat and are surpassed by other breeds in quantity of milk, but are unrivalled in the economic production of fat, which is an important matter in selecting a cow for the dietary requirements of infants and invalids. As the successful development of a dairy herd depends more upon the selection of the bull than on any other thing (except perhaps it be the proper culling out of inferior cows), it is important to select a bull having daughters in milk in order to learn the characteristics he transmits to his offspring. With regard to cross-breeding, the book states that, although it is common among American farmers, the practice is not to be recommended. The proper course is first to select the breed that best meets the requirements and then to continue along this line unless it is found after sufficient trial, that a serious error has been made.

In the chapter dealing with feeding, it is shown that cotton-seed meal, the by-product after the oil is extracted, contains a higher amount of protein than any other common food. For this reason it is specially valuable for balancing rations deficient in protein, for example, those in which corn or corn products form a large proportion. It should not however be fed to excess. As a rule, from 2 to 4 lb. should be the maximum, but in the Southern States, where it is abundant, it is fed in much larger quantities with good results.

The remarks as to sanitary milk deserve careful consideration in the West Indies, for milk is known to be a carrier of disease germs, and the danger that such germs will get into milk during handling is much greater than the danger of the transmission of the disease directly from the cow. The general subject of milk sanitation may be summarized in the following statements: (1) Use only healthy cows; (2) milk should not be handled by anyone suffering from contagious or infectious disease or anyone associated with the person so affected; (3) the cow's body should be kept free from manure; (4) the milker should have clean clothes and should milk with dry hands; (5) the utensils must be properly washed and sterilized; and (6) the milk must be sterilized immediately and kept cool until consumed. Throughout the West Indies there is need for the inspection of dairies and for the education of public opinion on the importance of the production of milk under sanitary conditions as well as on the great food value of milk.

As regards the value of cow manure, some interesting details are given. From experiments it has been found that about 15 tons of manure per cow can be produced a year, but, of course, much of this is lost when cows are working or at pasture. On the loss of manure by too long exposure sound advice is given. Exposure for five months results in the loss of half its value, and it is recommended that the safest place, in every way, for manure is on the land and that it should be spread as soon as possible.

At the end of each chapter in this text-book are to be found questions on problems dealt with therein, which enable the reader as he proceeds to digest each subject thoroughly, together with references to further sources of information and collateral reading and courses of laboratory exercises. Written in a simple non-technical style, well illustrated and indexed, this admirable book, though primarily designed for use in schools and colleges, will be of great practical utility to those in the West Indies who have to do with the care and management of cattle.



AGRICULTURE IN BRITISH GUIANA.

The Annual Report on the Lands and Mines Department in British Guiana for 1916, by the Acting Commissioner deals, in some parts, with the industries of the whole Colony and is of considerable interest.

In the year under review twenty grants by purchase for an area of 133 acres and one homestead grant for 5 acres were issued, while, during the same period, 113 grants with an aggregate area of 1,099 acres were cancelled for noncompliance with the conditions attached to the titles. Owing to the delay in the approval of the form of lease of Crown lands, which held up the issue of title from December 31, 1913, to November 1915, there was a considerable accumulation of applications on hand and the number of leases was phenomenally high, 529 leases for an area of 50,374 acres being issued. So far as can be judged at present, the recent substitution of ninety-nine years' leases for conditional grants leading to freehold title, has had no deterrent effect on the number of applications for agricultural areas. In fact, there has been an increase in the aggregate area applied for, notwithstanding the fact that applications are now limited to 5 acres, unless the applicants are able to adduce proof of being financially able or otherwise capable of cultivating a larger area, which prevents people taking up 25 acres as formerly, and, while allowing the back lands to lie idle, permitted them to utilize merely a small area of the front portion of their holdings.

Once a genuine agricultural community has become established in a locality, the progress once begun is steadily maintained, and few titles have to be cancelled owing to abandonment of the holdings. The East Indians, in particular, seem given to forming these communities, and, wherever they are established, prosperity and independence are the invariable reward of their industry. There is, it is noted, a steadily increasing demand for Crown lands for the purpose of growing rice, and in every district rice mills are springing up. It is hard to realize how rapidly the rice cultivation in British Guiana has advanced until now it takes second place to sugar-cane cultivation as a staple industry of the Colony. Reliable data as to the area under cultivation and the actual output are not available, but a comparison of the export figures show that 20,289,568 lb. were exported in 1915 as against 29,139,265 lb. in 1916, an increase of no less than 8,849,697 lb. on exports alone. When it is considered that the importation of rice, which averaged 39,000,000 lb. over a period of twenty-five years prior to its cultivation in the Colony, has entirely ceased, owing to the local product usurping its place, it is obvious that, considering the increase in population, the total production cannot be less than 70,000,000 lb.

The demand for Crown lands for the purpose of grazing cattle is also steadily increasing. Thanks to the admirable work of the Board of Agriculture and the hearty co-operation of the sugar planters in importing and distributing thoroughbred English and American stock, many fine herds of cattle are to be seen in different parts of the Colony, and prospective ranchers need anticipate no difficulty in procuring excellent cattle, thoroughly seasoned and suited for the preliminary stocking of ranches. While too much stress cannot be laid on the great possibilities of the large savannahs in the hinterland, when these are connected with the coast by railway, there are even now on the lower reaches of the navigable

rivers of the Colony large areas of excellent savannah land suitable for ranching purposes.

The output of balata during 1916 was greater than for many years past, the quantity on which royalty was paid being 1,478,631 lb. The industry was adversely affected at the commencement of the war, but the enormous demand for balata belting for power transmitting purposes in factories, arsenals, and munition works forced up the price to record figures, and, during 1916, the market remained steadily at high prices. In the districts where inspection was practicable, the work of bleeding was found to be fairly good, and this no doubt is due to improved supervision and increased skill among the bleeders. The chief fault, at present, is excessive bleeding at one operation, a practice found to be as unnecessary as it is destructive, the maximum yield being produced by bleeding the tree on one side at a time, as required by the regulations. In consequence of urgent representation of a large section controlling the industry, and, on the advice of the scientific staff of the Department of Agriculture, the Government decided in 1916 not to enforce the regulation prohibiting the use of 'spurs', or climbing irons, by bleeders, until further proof that the use of these spurs is as injurious to the trees as has been hitherto thought. The number of labourers licensed during the year to serve in connexion with the balata industry was 4,172.

The quantity of timber exported in 1916, though greater than in 1915, is still less than half the quantity exported before the war, this being due entirely to the shortage of shipping facilities. Wood operations on the Crown lands continued steadily during the year, and 128 licences, covering an area of 545,189 acres were issued, while 207 licences, covering an area of 247,344 acres were renewed. The increased cost of corrugated iron sheets and the reduction in their importation for lack of shipping space led to an increased use of wallaba shingles, 2,355,750 shingles being exported, while there was also an increase in the exportation of firewood to the adjoining West Indian islands.

The report, in dealing with the different industries, is useful in removing the prevalent impression that the resources of British Guiana are almost solely confined to sugar cultivation and to emphasize the enormous possibilities of development, should railway communication with the interior be established and a plentiful supply of labour be available.

AGRICULTURE IN BARBADOS.

The rainfall for July has been a record one. In a few districts it will not fall short of 20 inches. In most parishes the total will exceed 12 inches. There has been a daily regularity of showers or rains, and so thoroughly saturated is the earth that a shower of 15 or 20 parts presents the appearance of there having been a downpour. With the exception of the very heavy rain in the northern parishes on the 7th instant, the rainfall each day has been most impartial. Each cloud seemed to envelop the island and evenly distribute itself. Planters are earnestly hoping for a spell of fair weather to enable them to get through with matters which are urgent, and which, if delayed, will disorganize their work at a later date.

The largest rainfall for July during the past sixty-four years was 15½ inches in the year 1901. At this time last year there was need of rain, particularly in St. Philip and Christ Church, and the provision crops had begun to suffer. The record for last July was less by 50 per cent. than that for the present month.

The plant canes in the black soil, except perhaps in St. Lucy, are all that could be desired. They are under an excellent growth and quite advanced enough for this season of the year. They are also healthy and the bunches are full. In St. Philip, Christ Church, St. Michael, and the greater part of St. George, a visitor would find it hard to believe that there had been any difficulty in establishing the cane crop or that there had been a subsequent drought. The present condition of the island is just the reverse of past years. The hilly parishes have always suffered less than the low lying districts, which have invariably borne the brunt of a prolonged drought.

Both the B. 6450 and Ba. 6032 are developing splendidly, while the B.H. 10 (12) is attracting the attention of many planters. At the next planting season, we are informed that a fairly large area of the last mentioned seedling will be planted. In the red soil, however, the Ba. 6032 does not always inspire confidence.

In a recent report referring to insect pests, we noted that the mongoose had upset the balance of nature by preying upon the enemies of these pests. It is true that the rotation of crops helps in some degree in controlling the pests of economic plants, but it is to Nature that we must look for real assistance. If her balance is destroyed, the efforts of man are but temporary expedients. So far, perhaps, we have not suffered so much as some other places from the ravages of insect pests, but we should not wait until this takes place to take in hand what seems to us a very plain duty. The destruction of the mongoose is a necessity, and a general crusade should be started against this animal. Sixpence per head would not be too much to pay to catchers.

The Trinidad Board of Agriculture have taken up the question warmly, as they recognize the gravity of the situation. It behoves us to do the same, for no expenditure would be too great to accomplish an object of such importance to an agricultural community. Insect pests can only be kept in subjection by their natural enemies, and if these are destroyed no substitute can be provided.

The yam crop is much less advanced than at this time last year, owing to the later planting caused by the drought. The fields planted are, however, growing quite regularly and healthy, and on several estates manure is being liberally supplied.

No disadvantage is likely to result from the late planting beyond the fact that harvesting will not be done until some time after the next cane crop has been planted. There are also very few spots of early yams to be seen, as compared with last year, and eddoes have not yet been planted to any extent. The weather has been rather heavy for the potatoes planted in heavy fields, but otherwise the slips are running well, and give promise of a good return. (*Agricultural Reporter.*)

Rotation for Cassava.—Although several crops of cassava can be raised in succession on rich, newly cleared land, a proper system of rotation must be practised sooner or later to prevent deterioration of the soil. In West Africa a system of rotation sometimes practised is to grow ground nuts or some other leguminous crop the first year, two crops of a cereal, such as maize, the second year, and then to raise one or two crops of cassava, which may occupy the ground for two or three years. In countries where the sugar-cane is cultivated, cassava may enter into the system of rotation with advantage. The cultivation of the cassava with its surface-rooting habit mellows the soil, and at the same time the crop benefits from the manure which has been applied to the sugar-cane as well as from the humus derived from the leaves and waste of the cane. (*Bulletin of the Imperial Institute.*)

PELLAGRA IN BARBADOS.

In the quarterly report of the Acting Public Health Inspector for the period ended December 31, 1916, which appears in the Barbados *Official Gazette*, Vol. LII, No. 61, p. 1,307, are contained some interesting tables showing deaths from pellagra in the almshouses and Lunatic Asylum in the eight years 1909 to 1916. From these tables it is evident that pellagra is less prevalent in the country parishes than in St. Michael and Bridgetown, for in the period under review the disease accounted for 12.5 of all the deaths in the country almshouses, while in the St. Michael's Almshouse it claimed 27 per cent. High as is the death-rate from pellagra in the St. Michael's Almshouse, it is still higher in the Lunatic Asylum where it accounts for 46.3 per cent., and in 1916 reached the enormous rate of 76.3 per cent.

By far the highest incidence of pellagra occurred in 1912 and 1914, in both of which years were periods of prolonged drought accompanied by lack of proper food and widespread destitution and suffering. Among the theories advanced as to the cause of the disease, that having probably most foundations, is that pellagra like beri-beri, scurvy, etc., is a deficiency disease due to the want of some vital element in the food of the persons attacked. What this special element is that is lacking in the food of pellagrins has not been accurately determined, but it is suggested that it is probably a deficiency in the nitrogenous or proteid part. This view, the writer of the report maintains, is supported by the following facts: (a) Pellagra occurs chiefly among the poorest classes of the community who eat very little proteid food either in the shape of meat or peas, beans, etc.; (b) it is less prevalent in the country districts, where these articles of food, especially vegetable proteids, are more easily obtainable by the poor; (c) in years of drought, when less proteid food is produced and is more costly, the disease spreads and affects a much greater number, many of whom have been forced across the borderland to pauperism; and (d) no mention can be found of a case of pellagra having occurred at the Lazaretto where a more liberal diet is provided than at most public institutions.

Although the coincidence of pellagra with scarcity of proteid and nitrogenous food deserves thorough investigation, the vitamin theory should not be overlooked.

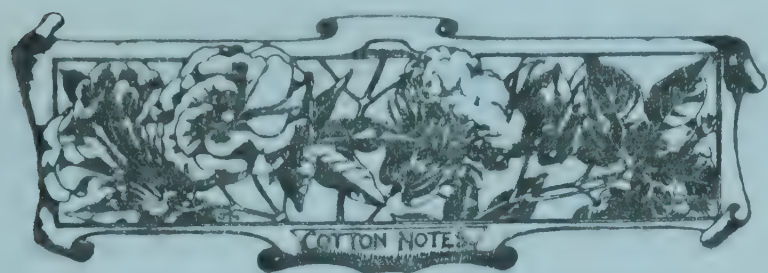
STORAGE ROOM AND THE PRICE OF CACAO.

The following is an extract from a letter from Messrs. Gillespie Bros. & Co., of New York, dated July 7, 1917, to the Imperial Commissioner of Agriculture for the West Indies, regarding the effect of the shortage of storage space upon the price of cacao:—

We have forwarded you under separate cover our private market report covering the different markets and wish to call your special attention to the heavy market covering cacao.

We think it should be pointed out to all shippers of cacao that they exercise great caution just at present until considerable parts of the shipments have been assimilated, for storage space is now becoming very scarce, and storage rates have been advanced 2c. per bag from the 1st of July.

You can naturally understand that if receivers of cacao are unable to find storage room, that this will bring about forced sales at marked declines. The situation to say the least is very depressed, and we believe the exact position should be pointed out to all shippers, as they are too fond of comparing quotations that rule in London (which point they cannot ship to) with actual prices realized in the New York market.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland of Liverpool, write as follows, under date June 26, 1917, with reference to the sales of West Indian Sea Island cotton:—

All Sea Island cotton continues to be in demand, and prices remain very firm at full official quotations.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and sixtieth meeting of the Council was held at the offices, 15, Cross Street, Manchester, on Tuesday, June 5, 1917.

A telegram was read from the President (The Right Hon. the Earl of Derby, K.G.) regretting his inability to be present at the meeting owing to important business in London. In the absence of the President and of Mr. J. Arthur Hutton, Mr. Joseph Hilton occupied the Chair.

It was reported that nothing further had been heard from the Board of Trade with reference to the Committee to be appointed to inquire into the future of the cotton-growing movement in the colonies. It is expected that a statement would shortly be made in the House of Commons, and it was suggested that if no further information regarding the Committee was received within the next month, some action should be taken in the matter.

WEST AFRICA. Owing to shortage of tonnage there is little prospect of shipping cotton seed from West Africa for some time, and arrangements have been made for the Association's oil mill at Ibadan to be kept working this year at its fullest capacity. Cotton is now coming forward more rapidly from West Africa, and about 5,000 bales of the new crop have already been shipped.

The quality of the new cotton crop is quite satisfactory. The Government Agricultural Department are taking steps to establish in Northern Nigeria a new variety of cotton which gives a much higher percentage of lint than the native type, and the opinion was expressed that if the whole of the cotton from Nigeria was of the same quality there would be a great future for the industry. There are 148 tons of seed of this variety available for distribution for the coming season, which at a low estimate, should produce over 2,000 bales.

The purchases of cotton in Lagos to June 2 amounted to 6,749 bales as compared with 8,019 bales for the same period of last year, and 3,430 bales for 1915.

To the end of April the purchases in Northern Nigeria were 3,413 bales as against 9,617 bales for the same period of last year, and 282 bales for 1915. The failure of the crop was entirely due to adverse climatic conditions, the Harmattan winds commencing the day after the rains ceased.

UGANDA. The Association's manager reports that the crop generally is below expectations this year, the rainfall having been abnormal, and will not exceed 25,000 against an estimated production of 40,000 bales.

SUDAN. It was reported that last season's crop at Tokar was the largest on record and is expected to yield 70,000 kantars. The Tokar crop could probably be increased by 50 per cent. if the floods were controlled, for which an estimated expenditure of £100,000 is required.

NYASALAND. It has been reported that cotton cannot be shipped from Nyasaland in consequence of the lack of shipping facilities, and representations have been made to the Government that it would be a great misfortune if the Association were unable to take cotton off the hands of the natives who had been encouraged to grow it along with their food stuffs.

At the one hundred and sixty-first meeting of the Council held on Tuesday, July 3, 1917, Mr. J. Arthur Hutton, in the absence of the President, occupied the Chair.

WEST AFRICA. The purchases of cotton in Lagos to June 30 amounted to 7,299 bales as compared with, 8,420 bales for the same period in last year, while the purchases in Northern Nigeria to May 31 were only 3,427 bales as compared with 10,092 bales for the corresponding period in 1916.

UGANDA. The percentage of lint to seed-cotton in the late crop was lower than in previous years being a yield, in some districts, of 28 per cent. as against 30 per cent. formerly. This is a matter which requires careful watching, but it is considered that this reduced percentage may be mainly due to unfavourable weather.

Advices have been received that cotton cannot be shipped from Uganda, as it is not included in the priority list. This is a very serious matter, because if the past season's cotton cannot be shipped, it will not be possible to arrange for the purchase of next year's crop.

NYASALAND. The crop prospects are good all over the country, but, unfortunately, the difficulties as regards shipping which exists in Uganda apply equally to Nyasaland.

GENERAL. It was reported that 5,850 bales of the Association's cotton has been sold during the month.

DEPARTMENT NEWS.

On Friday, July 20, the Antigua Agricultural and Commercial Society entertained Sir Francis Watts, K.C.M.G., at an 'At Home' on the grounds of the Industrial School to which not only the members of the Society but also their friends were invited.

With the approval of the Secretary of State for the Colonies, Mr. W. R. Dunlop, Scientific Assistant on the Staff of the Imperial Department of Agriculture, has proceeded to England, on leave, with a view to taking up active service in His Majesty's Forces.

During Mr. Dunlop's absence on leave Mr. F. H. Watkins, I.S.O., will perform the duties of Scientific Assistant.

INDUSTRIAL ALCOHOL.

Owing to the war the large market for rum which used to exist has been cut off at a time when British Guiana, Trinidad, and Jamaica are producing more than at any previous time. On the other hand, the necessity for the use of industrial alcohol has grown to an enormous extent, while the large quantity of potato spirit produced in Germany is naturally not available. Enormous quantities of alcohol are required in the production of munitions alone, for it is used as a solvent for gun-cotton in connexion with a fulminate employed in shell-fuses, a solvent for drugs, etc. In fact, the Minister of Munitions announced that the requirements of alcohol in the production of munitions, for the transport and air services and for other purposes directly connected with the war, are increasing to such an extent that an Advisory Committee to consider the best means to be adopted for securing adequate supplies to meet the demand for war purposes and the essential industrial trades has been appointed. Alcohol has therefore been manufactured in the United Kingdom to meet these wants, but its production has become more and more expensive, and a further disadvantage is that it has to be made from valuable grain like wheat, barley, maize and potatoes, all of vital necessity as food. It has been officially suggested by the Jamaica Government that, as rum is produced from a waste product in the production of sugar (waste product being used in the sense that it cannot be used for food), namely, molasses, it might be well to consider the production of industrial alcohol from that source. So long as rum could be exported profitably, it was difficult to obtain consideration on this point; but now there is an entire prohibition of rum. Both in the United Kingdom and Jamaica large stocks are held in the bonded warehouses; and as this year rum will not be saleable, it is urged that the existing stocks, as has been done in France, should be denatured and that, for the present, molasses should be converted into industrial alcohol. These facts apply with equal or greater significance to conditions in British Guiana. The Minister of Munitions is, therefore, desirous of obtaining supplies of industrial alcohol from the West Indies.

Few persons fully realize that, besides being a powerful stimulant and a clean useful fuel, alcohol is of growing importance in industrial progress as a source of power for use in engines, motors, heating and lighting, and that, when used for similar purposes, is termed industrial alcohol. Industrial alcohol is simply alcohol treated by a process which destroys its character as a beverage, renders it unfit for liquid medicinal purposes and prevents its use in any manner except for industrial purposes.

The process of rendering alcohol unsuitable for drinking is called 'denaturing', and consists, essentially, in adding to the alcohol a substance soluble therein of a bad taste or odour, or both, of an intensity which renders it impossible or impracticable to use the mixture as a drink. The substances added must be of such a nature as to render their removal very difficult by simple operations. In England completely denatured alcohol (mineralized methylated spirit) is made by adding 1 part of wood naphtha to 9 parts of grain alcohol (50 per cent. above proof), and to the mixture 0.375 per cent. of mineral naphtha (petroleum). Retailers are only permitted to sell completely denatured alcohol. In the United States the denaturing mixture is $\frac{1}{2}$ volume benzine plus 10 volumes methyl alcohol to 100 volumes ethyl alcohol, while in Germany, the usual denaturing agents for ordinary alcohol used for burning purposes is 2 per cent. by volume of wood spirit plus $\frac{1}{2}$ per cent. of pyridine bases or a mixture of benzol and light petroleum.

The alcohol occurring in distilled beverages is principally derived from maize, rye, barley and molasses, and in its production a careful selection of materials is required in order that the desired character of drink may be secured. For instance, in the production of rum, the molasses derived from the manufacture of cane sugar is the chief raw material. In the fermentation of molasses a particular product is formed which by distillation gives the alcohol compound possessing the aroma and flavour of rum. The chief agricultural sources of alcohol for industrial uses are those crops which produce starch, sugar and raw material of wood fibre. In the West Indies industrial alcohol can be made from molasses, arrowroot, bananas, cassava, corn (maize), rice, sweet potatoes, etc., and the British tropical possessions should produce it in quantities sufficient to render the Empire independent of outside sources of supply.

Although it has only half the heating power of kerosene or gasoline, industrial alcohol has many valuable properties which enable it to compete successfully with these rivals, in spite of its lower fuel value. In the first place it is much safer, as has been pointed out in an interesting work on the subject by Mr. F. B. Wright, U.S.A. Alcohol has a tendency to heat the surrounding vapours and produce currents of hot gases which are not usually brought to a temperature high enough to inflame articles at a distance. It can be easily diluted with water, and, when diluted more than one-half, it ceases to be inflammable. Hence it can readily be extinguished, whereas burning gasoline, by floating on the water, simply spreads its flame when water is applied to it. When, however, alcohol is used for lighting purposes, it is generally estimated that it possesses about double the power of kerosene, a gallon of alcohol lasting as long as 2 gallons of the oil. When used for street lighting in connexion with mantle lamps, alcohol vapour burns like gas with an incandescent flame and rivals the arclight in brilliancy, so that it requires to be shaded. Alcohol can also be employed in the same manner in cooking stoves. For motor purposes however, it has been pointed out that, although alcohol can be used for driving gas engines for ordinary running, it has not been found suitable for motor cars, because it has not the flexibility of petrol, such as is required for frequent starting and running at slow speed. It is said that this difficulty has been overcome by the addition of a certain quantity of benzol (benzene), which is a by-product of coal distillation, and by the invention of natalite.

It is estimated that 1 bushel of maize will produce 2.7 gallons, a bushel of sweet potatoes 1 gallon, and 3 gallons of molasses 1 gallon of industrial alcohol.

In considering the production of industrial alcohol in the West Indies, it is essential to calculate how far the price obtainable for molasses compares with the price of industrial alcohol after deducting the expenses of distillation. From a patriotic stand-point, the less alcohol distilled from foodstuffs, such as maize, the better. The subject certainly deserves careful consideration.

The Sugar Industry Agricultural Bank in Barbados.—From the Auditor's report for the year ended May 31, 1917, and published in the Barbados *Official Gazette* of July 30, it appears the total loans for that period, on the application of 125 owners of plantations, amounted to £210,755. The income derived from interest was £5,960, and the expenses amounted to £1,442, leaving a net income of £4,518. The accumulated profits on May 31, 1916, were £46,885, while on May 31, 1917, they amounted to £51,403. This sum, added to the Imperial grant of £80,000, places the Bank's total funds at £131,403. There were no bad debts.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue discusses the dangers of transmission of disease by flies.

Insect Notes, on page 250, refer to the principal natural enemies of hard-back grubs in Porto Rico.

The Plant Disease Note, on page 254, deals with the control of damping-off in seedlings, due to their infection by certain soil-inhabiting fungi.

On page 253 is to be found an epitome of the Annual Report of the Agricultural Department of Dominica for 1916-17.

Agricultural Commission in British Honduras.

A Commission has, it is reported in the *Clarion* of June 7, 1917, been appointed by the Acting Governor of British Honduras to inquire into matters concerning the production of foodstuffs within that Colony, and generally to investigate the needs of agriculture and the means best calculated to secure its development, and the conditions obtaining amongst the farming class. If the commission results in the adoption of measures broad in conception and flexible enough in application to fit them to a necessarily limited beginning while allowing free scope for safe and sound expansion as the beneficial effects of their working warrant an increase of facilities for that end, its appointment is one of the most important steps ever taken for advancing the interests of the Colony.

Advances upon Agricultural Produce.

An Ordinance No. 14 of 1917, published in the *Trinidad Royal Gazette* of June 8, 1917, repealing the Agricultural Produce Ordinance 1906, has been passed by the Legislative Council of that island to make provision for securing advances on agricultural produce. By section 4 of the Ordinance when any land together with any crop growing or to be grown thereon and the produce to be reaped or gathered therefrom and the product or article to be cured made or manufactured from such crop or produce are mortgaged or charged by any instrument in writing as a security for the payment of money, such crop and produce upon severance from the land and the product or article to be cured made or manufactured therefrom shall not be deemed to be personal chattels but shall be deemed for all purposes to be lawfully mortgaged or charged. It is also made lawful for the owner of any sugar factory to mortgage or charge sugars made or manufactured from canes to be purchased by such owners from farmers or others.

An instrument in writing may provide that the whole or any portion of the sum advanced shall be devoted to specific purposes, or that the whole or any portion of the crop shall be delivered to the mortgagee or that any money received by the mortgagor in respect of the crop shall be paid or applied in the manner specified in the instrument.

Agricultural and Industrial Exhibition in Trinidad.

In the report of the Joint Executive Committee of the Agricultural and Industrial Exhibition held at Port-of-Spain in March, it is said the value of spraying cacao was shown by an exhibit of the actual pods from one picking from equal numbers of sprayed and unsprayed trees, and of the total dry cacao yielded from the two plots during one season, while on the entomological side a useful display was made of the beetles of cacao estates. The Department of Agriculture, as is related in the report, which is reproduced in the *Proceedings of the Agricultural Society of Trinidad and Tobago*, Vol. XVII, p. 190, also focussed atten-

tion on the food question by showing in bulk the actual quantities of flour, rice, vegetables, etc., imported annually for each adult of the population, and by the exhibit in the grounds, of ground provisions which can be grown in one year on a small area; the yams, potatoes, etc. were exhibited on the soil as dug. The uses to which some of the provisions can be put were demonstrated by meals, etc., from the Tobago Botanic Station. A comprehensive rubber exhibit, including rubbers produced locally and manufactured articles, budded cacao and other nursery stock was also shown. On the stock side, the Department showed various stud and other animals, including the jack donkey recently imported.

Chiggers or Chiggoes.

In the *Review of Applied Entomology*, Vol. V, Series B, p. 63, it is stated that the domestic pigs in Costa Rica are infested by chiggers (*Dermatophilis penetrans*, L.). When these are driven through the streets, they infest the soil in them, the chief victims being the bare-footed children who play there. The sores are stated to afford an entrance for the tetanus bacillus, and during the past four years 1,147 deaths from tetanus are said to have occurred in the republic. Gas gangrene is also transmitted occasionally, and the deaths of two Europeans are definitely stated to be due to this. Where the chiggers are too numerous to be removed with a needle, as is generally done in the West Indies, the following ointment is advised: Salicylic acid, 2.5 grams; ichthyol, 10 grams; yellow vaseline, 10 grams. Local baths of petroleum are also useful, but tincture of iodine is not recommended. The best prophylactic measure would be to prevent infested pigs being brought through the streets, together with regulations for treating the animals in the piggeries.

In the West Indies where the children of many of the well-to-do classes are allowed to run about bare-footed, it is well to remember the dangers not only from chiggers but also of infection by hook worms.

The Higher Direction of Industry.

Organization, direction, co-ordination and knowledge are as essential to modern industry as they are to a modern army. The industrial army is always at war with nature. To maintain its place in the van with the industrial armies of other progressive nations, it will depend not only on the natural qualities of its own rank and file but also on its staff work, on its equipment being maintained at the highest possible pitch, on new developments being carried through, new ideas and inventions sought and welcomed, on the collection of detailed and world-wide information of trade and industry, and on the co-ordination of all the directing forces of the nation, political, industrial, scientific and financial, both to secure the utmost internal development and to conduct the strategic penetration of foreign markets. In a word, it will depend on the brains, adaptability and hard work of those who direct industry. (*Round Table*.)

Juvenile Education and Employment.

Any inquiry into education at the present juncture is big with issues of Imperial fate. In the great work of reconstruction which lies ahead there are aims which will try no less searchingly than war itself the enduring qualities of those on whose shoulders a share in the common burden of Empire rests. One of the chief problems will be to restore the natural relations between the folk and the food from which the folk derives its sustenance, to verify with fresh scientific methods and better economic conditions the worn-out practices of agriculture, and to learn over again that there is no greater benefactor than the man who makes two ears of corn grow where but one grew before. And to realize this, education with its stimulus and its discipline must be our stand-by.

In discussing the age at which boys should leave school, the final report of the Departmental Committee on Juvenile Education in relation to employment after the war states that, although it will prove easier to raise the standard of education in the towns than in the villages, it would be a fatal mistake to accept a lower standard as the one proper to be aimed at, not only for the sake of the large number of children who, although born and educated in villages, will certainly not spend their whole lives in those villages, but also for the sake of agriculture and of the agricultural population themselves. Agriculture is essentially from top to bottom a skilled industry, and if there is to be an agricultural revival, one of the most potent means for bringing it about must be an improved education, resulting both in a higher degree of planting ability and in a higher conception of the possibilities of village life.

University Degree in Horticulture.

The University of London has established a B.Sc. degree in Horticulture. Syllabuses for internal and external students have been drafted and the University has under consideration the recognition of the Royal Horticultural Society's school and research station at Wisley as a school of the University. If degrees are to be given in technical subjects, the case for horticulture is a good one, for, although horticulture is primarily a craft, and like all crafts depends for its successful pursuit on the exercise of practical skill, it is also an applied science.

From the point of view that tropical horticulture is in many cases akin more to horticulture than to agriculture practised in Great Britain, this degree is to be welcomed. Unfortunately, the regulations for the external degree provide for no training in practical horticulture. This defect might be met by the recognition of training, at Kew or at some of the establishments of the great commercial horticulturists, of those who, for various reasons, are unable to become internal students.

INSECT NOTES.

WHITE GRUBS INJURIOUS TO SUGAR-CANE IN PORTO RICO.

In the last number of the *Agricultural News* an account was given of the life-cycle and habits of a typical species of hard back beetle as studied by Mr. E. G. Smyth in Porto Rico. In the present issue it is proposed to refer briefly to the principal natural enemies of hard back grubs, as observed by Mr. Smyth.

The natural enemies of hard back grubs—or white grubs as they are often called—are grouped under three classes, namely, animals (including birds and lizards), insects (including mites and worms) and plants (fungus and bacterial).

ANIMAL ENEMIES OF HARD BACK GRUBS IN PORTO RICO.

Field mice and rats are mentioned as possibly accounting for a few specimens of grubs, but these cannot be considered of any great importance. An attempt was made by one of the sugar estates to introduce hedgehogs from Europe a few years ago, but owing to the unfavourable surroundings in which they were liberated, they did not become established. These hedgehogs ate hard backs greedily when fed to them in confinement, but they were not observed to burrow deep enough into the soil to get at the grubs, and it is questionable whether they would have been of any value as an agency of control had they become established.

Insect-eating lizards are very abundant in Porto Rico, but most of these, belonging to the genus *Anolis*, are too small to feed on the larger hard backs. Further, they are at work only during the day, usually on trees, whereas the hard backs hide in the ground during the day, only coming out at nightfall.

A large burrowing ground lizard (*Ameiva exul*) is mentioned as being a probable feeder on hard back beetles and grubs.

It may be mentioned that the genus *Ameiva* has a wide range throughout the West Indies, but the several species are quite localized, many of them being confined to a single island. This species, *Ameiva exul*, has a wider range than many of the other species of this genus being found upon Porto Rico, Vieques, St. Thomas, St. Croix, St. John, and Water Island. (Barbour, Thos. *Mem. Mus. Comp. Zool. Harvard*. Vol. XLIV, No. 2, 1914.)

Birds constitute an important factor in the control of hard back grubs in Porto Rico. The three most important bird enemies are: (1) the Porto Rican blackbird or 'mosambique' (*Holotrisacus brachypterus*); (2) the bare-legged owl (*Gymnas o nudipes nudipes*), and (3) the little blue heron (*Florida caerules caerulea*). The mangrove cuckoo (*Coccyzus minor nesiotis*) is also mentioned in this connexion.

The blackbird is regarded as the most important of these enemies because it is very abundant in the districts of Porto Rico where the hard-back grubs are most injurious, namely, in the arid coast regions. It was found by observation and count that over 90 per cent. of the grubs exposed by the ploughs are picked up by these birds. Mr. Smyth goes on to say that 'when it is considered that a bird is able to consume more than the equivalent of its own weight of food in twenty-four hours, and that blackbirds during the ploughing season of five to six months subsist almost wholly upon grubs, one may appreciate the vast numbers of grubs that they consume.'

INSECT ENEMIES OF HARD-BACK GRUBS IN PORTO RICO.

Mr. Smyth has found that among the insect enemies of melolonthid larvae and related hard-back grubs there are at least nine species known to occur in Porto Rico. Six of these are Hymenoptera, belonging to the wasp family Scoliidae, two are Tachinid flies, and one is an Elaterid beetle. At present very little is known about the parasites of these grubs in Porto Rico.

Of the nine species mentioned above 'there is direct evidence of only one of them destroying the grubs of *Phyllophaga* (*Lachnosterna*). This the Elaterid beetle (*Pyrophorus luminosus*), larvae of which have been fed upon *Phyllophaga* grubs for long periods in confinement in the insectary.'

It may be mentioned that this beetle is closely related to the luminous night-flying beetle *Pyrophorus noctilucus*, which occurs in some of these islands. This beetle is much larger and gives a much brighter light than the smaller 'fire-fly', belonging to the coleopterous family Lampyridae. Very little is known of the habits of the larva of *noctilucus*.

No definite statements can be made as to the value of *P. luminosus* larvae in the control of hard-back larvae under field conditions in Porto Rico. This species is apparently confined to the north and west coasts.

The scoliid wasp *Campsomeris dorsata* is known to parasitize the common black hard back (*Ligyris tumulosus*) abundantly at all seasons, but there are so far no definite records of its attacking *Phyllophaga* grubs in Porto Rico.

This species of *Campsomeris* (Dielis) is the common parasite of *Ligyris* in Barbados, and has occasionally been found parasitizing *Phytalus smithi*.

Mr. Smyth mentions that of thousands of *Phyllophaga* grubs collected in cane fields and examined by him, not one has ever been found parasitized by a scoliid egg or larva.

It would appear that the most important parasitic enemies of these *Phyllophaga* species in Porto Rico are the two Tachinid flies (*Cryptomeigenia aurifacies*) and *Eutrixoides jonesii*. Both of these flies are parasites of the adults, and Mr. Smyth says that further observations may possibly show that these parasitic flies lay their eggs on the beetles at the time that the latter are mating just before nightfall. The number of fly pupae found in one dead beetle varies from two to nine, and is usually from four to six.

It is further stated that infested beetles that have died as a result of this parasitism are always found in their burrows underground.

Like the *Pyrophorus* beetle mentioned above, these fly parasites appear to be found only in the more humid section of the north and west coasts, and Mr. Smyth thinks that the presence of these three enemies may help to explain why white grubs are less injurious in these regions than on the dry south coast where there are few or no Tachinid parasites or *Pyrophorus* beetles.

INTRODUCTION OF PARASITES INTO PORTO RICO.

After it was found that the native parasites of white grubs were quite insufficient to prevent the continual increase of these pests in Porto Rico, the introduction of parasites from outside was taken in hand.

This work was begun in 1911 by Mr. D. L. van Dine, at that time Entomologist of the Porto Rico Sugar Producers' Experiment Station. A special collaborator was employed to collect living white grub parasites, or parasite cocoons, in the United States, and ship them to Porto Rico in living condition. This work was carried on from June 1911 till October 1914, first by Mr. C. E. Hood, and later by Mr. G. N. Wolcott.

This same fungus has been used on a very large scale against the sugar-cane froghopper in Trinidad with good results.

J.C.H.

Solar Ovens—In view of the scarcity of coal or wood in many sub-tropical regions, such as Egypt, the Punjab and the Karoo of South Africa, it is interesting to note the report recently made by Sir F. Nicholson, describing valuable experiments in the employment of solar ovens. These consist of stout teakwood boxes, blackened inside and fitted with a double glass top. They are suitably insulated, and with this simple apparatus a temperature of from 240° to 275° Fahr. is easily obtained during the middle of the day from 11 a.m. to 3 p.m., and 290° with the aid of a single glass mirror. The oven once constructed, the *Journal of the Royal Society of Arts* for May 11, 1917, points out, costs nothing, and for all mere baking or cooking purposes it is a very efficient and cheap utilization of sun-heat, suitable for many applications. The disadvantage attached to the process namely, the hours possible for hot meals being reduced to those in the hottest period of the day, must not be overlooked.



GLEANINGS.

In an Act of the General Legislative Council of the Leeward Islands which was passed on February 14, 1917, to consolidate and amend the law relating to weights and measures, the standard measure of capacity of a barrel used in buying or selling limes was fixed at 26 Imperial gallons.

From a statement, reported in *The Board of Trade Journal*, Vol. XCVII, p. 673, the average price of British wheat per quarter of 8 bushels Imperial measure (a bushel of wheat=60 Imperial lb.) was 78s. 2d. for the week ended June 16, 1917, whereas for the corresponding period in 1914 the average price was only 34s. 1d.

Tuberculosis among hogs in the United States appears to be increasing to a serious extent. The tuberculous cattle are the main source of the disease which, according to *Farmer's Bulletin*, No. 781, is most commonly conveyed by feeding hogs on unpasteurized milk, or by allowing them to feed on the undigested grain in the droppings of diseased cattle.

Fifty-one margarine factories in Denmark produced in 1916, according to *The Board of Trade Journal* of May 31, 1917, 57,000,000 kilos. of margarine. The fat used by these factories is now mainly of vegetable origin. In 1916, 44,000,000 kilos. of coco-nut and other vegetable oils were employed as against only 10,000,000 kilos. in 1909 (kilogramme = 2.2046 lb.).

In the *Agricultural Journal of India*, Vol. XII, p. 266, it is reported that Major Leather, V.D., F.I.C., Imperial Agricultural Chemist, has retired after twenty-five years service with the Government of India. During the course of his service in India, Major Leather not only did much valuable chemical investigation but was also very successful in the training of Indian assistants.

At a recent general meeting of the Agricultural Society of Trinidad the proceedings of which are reported in the *Port-of-Spain Gazette* of July 11, 1917, a resolution was passed to ask the Government, in view of the success which has attended the Government Co-operative Lime Factory in St. Lucia, and of the rapidly extending cultivation of limes in the colony, to assist in the formation of a similar establishment for Trinidad and Tobago.

In measuring grain a quart of corn meal, according to *Farmer's Bulletin* 222, weighs 1.5 lb. and 1 lb. measures 0.7 quarters. A bushel of corn contains approximately $\frac{4}{5}$ cubic feet. To find the capacity of a bin, find the number of cubic feet and multiply by $\frac{4}{5}$ or multiply by 8 and divide by 10. Two bushels of ears are ordinarily required to make one bushel of corn, therefore to find the capacity of a crib, find the number of cubic feet, multiply by 4 and divide by 10.

In the editorial of a recent issue of the *Philippine Agricultural Review* it is stated that, on an average, 10 per cent. of every crop is a total loss due to the ravages of insect pests. A large part of this damage is so constant and is produced by insects so inconspicuous that the planter rarely knows of its existence, or, at any rate, is contented to regard it as a perfectly normal factor of crop production. The necessity of the application of practical entomology is obvious.

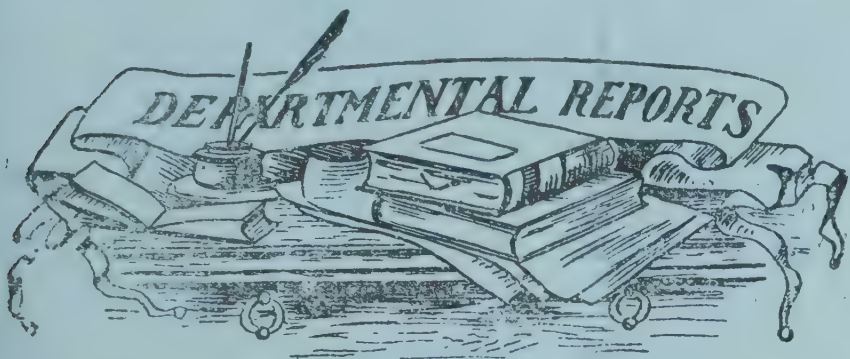
In a recent communication Mr. W. N. Sands states that in St. Vincent, preliminary operations were undertaken during May in all districts of the island for planting up lands in staple products and food crops. The weather was too dry, however, to allow of much planting to be done. Indications pointed to the fact that far larger areas of land would be put under cultivation than for some years past. The limiting factor, however, to the extension of the area under food crops is at present the labour.

In the *Journal of the Jamaica Agricultural Society* of April 1917, attention is called to the importance of the rice industry for the development of which suitable lands are available in Jamaica. After experiments in feeding horses, cows, pigs and poultry on rice bran, this by-product of the industry has become popular as a stock food. What is known as 'dry land' rice, or rice grown on the same kind of land as corn is grown, without irrigation, has been grown on a small scale, and the cultivation is increasing.

In the Barbados *Official Gazette Extraordinary*, Vol. III, No. 59 a, p. 1,289, the following maximum retail prices for sweet potatoes have been fixed under Act No. 12 of 1914, namely: (a). sweet potatoes not yet dug but still in the ground: not more than such a sum per hole as will make the price of the potato contained in the hole to be not more than 1 $\frac{1}{4}$ c. per lb. when the potatoes shall have been dug and weighed; and (b) sweet potatoes which have been dug out of the ground: not more than 2c. per lb.

In the *Review of Applied Entomology*, for April 1917, spraying walls, floors and all crevices with a pitch or tar solution at intervals of two days for a period of ten days is recommended as a control measure against cockroaches. Powdered borax both as a solution and in powdered form is effective. Strong solutions of creosote or creolin, or some commercial contact insecticides have also proved successful. Carbon bisulphide fumigation may be used in the strength of 12 lb. per 1,000 cubic feet of space.

The United States Bureau of Standards has completed a very careful determination of the freezing point of mercury, using platinum resistance thermometers to measure the temperature. The result of this work, according to the *Journal of the Royal Society of Arts*, Vol. LXV, No. 3,369, p. 542, gives - 38.87°C (- 37.97° F.) for this point. A knowledge of the freezing point of mercury is of great importance to thermometer makers, as it marks the lower limit to which a mercurial thermometer can be used, and furnishes a method for calibrating or printing the scale below 0° C. (32° F.).



DOMINICA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1916-17.

The occurrence of a hurricane on August 8, the second within a period of thirteen months, again interrupted the routine work in the Gardens and Experiment Stations. In consequence of the injury to the cacao and lime plots the plot experiments had to be recast and much time was taken up in repairing the damage caused by the storm.

With regard to the various methods advocated and adopted for dealing with situations occasioned by these visitations, it may be correctly stated that, during the quarter of a century in which the lime industry has been the major industry of Dominica, no general plan of action has been evolved for dealing with what is the most serious situation which the lime planter is called upon to meet. The methods practised in dealing with fallen trees are described as: (1) propping back the tree in original position; (2) removing the upper branches and propping up the trees; (3) stumping the trees; and (4) renewal of top by means of suckers from the base of the trunk, and the merits of each method are discussed in detail. Observations made during recent years in regard to the sour orange tend to show its great root-holding power, and, as the hurricanes of 1915 and 1916 indicate the need of a stock on which to grow the lime to prevent the wholesale overturning of trees at such times, experiments have been undertaken in this direction by budding limes on sour orange stocks.

In the matter of imported foodstuffs Dominica is in a more favourable position than some of the other Leeward Islands, for it is computed that for every 100 lb. of flour, corn meal, peas and beans, and rice imported into Dominica per head of population in 1914-15, Antigua imported 180 lb. and St. Kitts 162 lb. per head. The main obstacle in securing an abundant supply of home-grown produce to Roseau is the difficulty of transport. The vegetable most popular with the peasantry is the Dasheen (*Colocasia antiquorum*, var. *esculenta*), the yam of the Fijians which was introduced into Dominica from Martinique about thirty years ago. Another important root crop is the cassava (*Manihot utilissima*) which is largely grown in the Windward districts and forms one of the principal foods of the people throughout the island. The meal or farine can be stored for months, and this gives it considerable value as a foodstuff in times of drought and scarcity. Though large quantities of peas and beans are grown locally, there is not sufficient production to meet local requirements and over 40,000 lb. are imported annually. The increased production and consumption would give a better balanced dietary, which would mean better health and more energy to the consumers. Although in normal times the existence of wild food-plants and the abundance of breadfruit trees are deplored by employers of labour as tending to make the people indolent, Dominica, at the present crisis, is fortunate in having three wild food-plants, namely, the 'Waw-waw' or Carib yam (*Rajania pleionura*), the Baba-ou-lé, a kind of yam, and the Topee Tambou (*Calathea Allouya*), which in times of stress might be of inestimable service.

In the staple industry the lime crop for 1916, calculated in barrels of a capacity of 4.55 cubic feet, amounted to 384,298 barrels to which concentrated juice contributed 60, raw juice 20, fresh limes 10, and citrate of lime 10 per cent. Although the number of barrels was 6,160 below that of 1915, it is remarkable that such satisfactory results should have been achieved in spite of bad weather conditions. The values of the different forms of lime products were: concentrated lime juice, £44,379; raw lime juice, £50,452; raw lime juice cordial, £772; green limes, £47,852; pickled limes, £415; citrate of lime, £9,244; essential oil of limes, £16,803; and otto of limes, £2,435, or a total of £172,352. Compared with the previous year there was a total decrease in values of £2,052. The heavy shipments of raw lime juice during the past two years have been due in a large measure to the requirements of the Allied Armies and Navies. It is unsatisfactory, on the other hand, to note that during the same period, which has been one of unparalleled prosperity in New York and other great cities, the shipments of green limes to the United States have fallen off to the extent of 6,000 barrels, and this decrease cannot be attributed to lack of shipping facilities or any falling away in the demand, but to the efforts of those who have made great attempts to build up a sound trade creditable to the island by the shipment of produce of the highest quality, being largely discounted by the irresponsible action of others who forward inferior fruit to the market. Proposals were, at the end of 1916, laid by the Administrator before the newly formed Chamber of Commerce with a view of organizing a system for the inspection of fruit before shipment.

The section of the report which deals with the work in the recently established chemical laboratory shows that the number of samples of lime juice sent in by planters is steadily increasing and deals with the improvement in the manufacture of lime products, the chief difficulty in preparing clean juice being the treatment of the sediment, which is discussed, as is also the point of economic concentration.

There is a movement on foot in Dominica to establish Agricultural Credit Societies similar to those existing in St. Vincent, where the effort has met with considerable success. The assistance most urgently required by the small owners is some means of disposing of their lime crop, and a scheme has been formulated for the erection of a Government Co-operative Factory at Grand Bay, where a crop estimated at 6,000 barrels is produced annually.

The series of manurial experiments with lime cultivation which commenced in 1913, has now come to an end. Several important general principles in the manuring of limes have been brought to light, namely, that the application of a complete manure of nitrogen, phosphates and potash has resulted in a substantial and remunerative increase in crop; that the application of manure containing nitrogen and phosphates, but no potash, has given remunerative increases; that good results appear possible by the use of nitrogen alone; and that it is not advisable to apply either phosphates or potash alone without nitrogen. Although the experiments were not sufficiently prolonged to demonstrate the value of mulching, the indications were that, in course of time, the mulched plots would have given yields comparable with the complete manure plots of limes. The chief feature of the cacao experiments has been to prove that by maintaining the humus content of the soil by systematic applications of organic matter, it is unnecessary to resort to the use of artificial manures. With a view of ascertaining the least amount of mulch necessary to produce satisfactory results, a plot was started in 1913-14, which received only 2½ tons per acre as against the higher amounts (4 tons and 5 tons) on the other mulched plots.



PLANT DISEASES.

THE CONTROL OF DAMPING-OFF.

Damping-off is the term applied to the failure of seedlings due to their infection while in a tender state by certain soil-inhabiting fungi. The reason for the name is the association of the trouble with conditions of more or less excessive moisture, which favours the development of the parasite at the same time that it increases or prolongs the tenderness of the plants. Though not necessarily confined to seedlings crowded in boxes or seed-beds, it is amongst such that the affection usually appears and, by progressive infection, is able to cause extensive losses. Merely reducing the density with which the seed is sown is often sufficient, by permitting increased ventilation, preventing the drawing up of the seedlings, and making the spread of infection more difficult, to avoid or reduce the damage.

The longer the soil of the seed-bed has been in use, and the more decaying animal or vegetable material it contains, the more likely it is to harbour fungi capable of causing damping-off. Heavy, water-retaining soils are more favourable to the affection than those which are light and porous, and provision for rapid drainage is one of the most important precautions against it. Over-shading and close shelter, by maintaining humidity, increase the tendency to it; in these respects, as in the supplying of water, the conditions which favour the seedlings favour the disease, and a mean has to be struck between slow growth and loss.

The trouble occasioned by damping-off in these islands is not so great as might be expected by an agriculturist accustomed to temperate countries, where warm, humid weather, such as is associated with ideas of the tropics, is greatly feared in this connexion.

In the first place nearly all the staple food plants, sugar-cane, bananas, tannias, dasheens, sweet potatoes, yams, cassava, are raised from cuttings of one sort or another. Cotton, corn and pulses, which are raised from seed, are planted a few seeds together, in their permanent positions in the open ground. Of agricultural as distinct from garden crops tobacco, onions, and limes, which are raised in seed-beds, have been the plants to suffer most in the West Indies from the affection under notice.

Notes on the subject, embodying the results of experiments conducted in the United States, were published in Volume XIII, of this Journal (p. 380). A bulletin, recently received (*United States Department of Agriculture Bulletin No. 453*) by Messrs. Carl Hartley and Roy G. Pierce, states the conclusions derived from further studies, made on coniferous seedlings.

The authors point out that the methods of prevention commonly adopted by nurserymen, such as the use of sandy soil, the use of sand or gravel for surfacing the beds, the provision of good drainage and ventilation, while often successful, do not avail to prevent heavy losses under unfavourable circumstances, while the withholding of water often does as much direct harm as the affection which it is sought to avoid.

The use of imperfectly rotted manure, of lime, of wood ashes, and of a mixture of coal and wood ashes are indicated as having had bad effects.

The one means so far discovered which can be relied upon to give satisfactory results under any reasonable conditions is the disinfection of the soil. The question remains as to which of the various methods available for this purpose it is most convenient to adopt. The use of steam or of formaldehyde has been widely recommended, but these methods are so expensive as to be impracticable except for relatively small quantities of valuable material, as in green-houses or market gardens. The method of their application has been already outlined in this Journal (Vol. XIII, pp. 78-9).

For the broader requirements of nurserymen the treatment finally adopted by the authors of the bulletin under review consists in the application in standard soils of three-sixteenths of a fluid ounce of commercial sulphuric acid to each square foot of seed bed, applied in solution in water immediately after the seed is sown and covered. This has proved more reliable than the more expensive methods mentioned above.

The amount of water used to carry the disinfectant does not appear to be a matter of importance, provided that the necessary amount of the acid is applied to each unit of area. The quantity used by the authors varies from 1 pint per square foot when the soil is wet to 2 pints when the soil is dry. There is a possibility, especially in light soils, of a concentration of the acid by evaporation to a strength injurious to the root-tips, which in practice has been found to be completely avoidable by watering the beds frequently during the period of germination. When the root-tips have penetrated to a depth of half an inch this is no longer necessary.

There are differences in the amount of acid required for successful results in different soils. In sandy soil which was probably somewhat alkaline, a heavier application, one-fourth to three-eighths of an ounce, was indicated. In a fine sandy soil which was probably already acid, chemical injury to seedlings was more difficult to avoid, and reduction of the acid to one-eighth of an ounce was advisable. On heavier soils the use of five eighths of an ounce produced no injury, and reduced losses by damping-off to less than 1 per cent.

On a soil with a high carbonate content, evidenced by a vigorous effervescence when the acid was applied, the method was found to be ineffective. On this soil the use of copper sulphate, one-fourth ounce per square foot, gave good results. This substance was applied in the same way as the acid, and the same precaution to avoid chemical injury was found necessary.

An interesting indication was given by the experiments of the effectiveness of cane sugar, $2\frac{1}{2}$ oz. to the square foot, in the control of damping-off. The authors point out that if some unrefined sugar-bearing substance were available, it is possible that for certain soils the application of sugar would become an economically satisfactory treatment. Experiments on this subject might well be carried out in the West Indies.

There are secondary advantages to be expected from sulphuric acid disinfection which may be of considerable importance in some cases. Under appropriate circumstances a larger germination percentage is secured, the number of parasites in the soil is reduced, and the well-known effect of disinfection on fertility results in increased growth. Another valuable effect has proved to be the reduction of weeds owing to the greater susceptibility of their seeds.

In considering the application of the methods to local conditions, it is necessary to emphasize the fact that the results stated have been obtained with the seedlings of a definite group of plants, the conifers. It will be necessary to find by experiment how far they are transferable to the

seedlings of unrelated plants. In view of the difference of soils, moreover, such experiments must be carried out in the situation where the seedlings for which it is proposed to adopt the method are raised.

Some hints are given as to the method of handling the acid. It should always be dissolved by pouring it into the water; reversing the process may cause a serious accident. The solution should be made up in wooden or earthen containers and applied with watering cans which have been coated inside with paraffin wax. Boots may be protected by being heavily greased. Wooden containers should be washed out, immediately after use, with water containing washing soda.

W.N.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market for the month of June 1917:—

The month of June commenced with a somewhat stronger business tone than has been the case for some time past, but this was not expected to continue, as the approach of the half-year, taken in connexion with the holiday season, always brings with it a certain amount of depression, even in normal times; and when in addition to these drawbacks there are the continued shipping difficulties and dangers, together with high freights, it cannot be said that there has been much, if any, general improvement since our report for May. The following are the chief items of interest.

GINGER.

This spice was represented at auction on the 20th of the month by 933 bags of Cochin and Calicut. Of this some 163 bags of small, rough washed Cochin fetched 70s. per cwt. White rough brown Calicut was bought in at the same figure. Some 95 bags of Japanese were also offered, but 35 only found buyers at 38s. 6d. for partly mouldy limed. Quite at the end of the month the quotations were as follows: 95s. to 105s. for medium to good Jamaica, and 90s. to 92s. 6d. for common to good common Jamaica, while washed Cochin was quoted at 70s., brown Calicut at 55s., Sierra Leone at 52s., and Japanese at 48s. per cwt.

SARSAPARILLA.

The offerings at auction on the 28th of the month were as follows: Mexican 25 bales, Honduras 9 bales, and native Jamaica 2 bales. Neither the Mexican nor the native Jamaica found buyers, the first being held at 1s 5d. and the second at 2s. Of the Honduras 6 packages were sold privately, the other 2 packages being held at 2s. 4d.

CITRIC ACID, CANELLA ALBA, CASHEW NUTS, CASSIA FISTULA, KOLA, LIME JUICE, ANNATTO SEED, AND TAMARINDS.

Citric acid was in large supply at the first auction on the 7th of the month, as many as 120 kegs and 16 casks being offered, and sold at 3s. 3d. per lb. A week later, 3s. 4d. was the price quoted, and at the end of the month 3s. 5d. was asked. Canella alba bark was represented at auction on the 7th of the month by 10 packages, but none was sold. At the same auction, 55 packages of cashew nuts were offered with a like result, and 25 packages of Cassia Fistula shared

the same fate; kola, however, met with a more favourable reception, 51 packages, out of 66 offered, being disposed of at the following rates: 6½d. to 6½d. per lb. for 30 bags of good Java halves; for 21 bags of whole and halves slightly wormy, 6d. per lb. was realized, and for small slightly wormy 5d. to 5½d. was paid. At the last auction on the 28th of the month, 16 packages were offered and all were disposed of, fair to slightly wormy West Indian fetching 5½d. to 6d., while for small, partly broken Java, 5d. was paid. For lime juice there has been but little demand, owing principally to the difficulty in obtaining sugar for its proper preparation as a drink. At the end of the month fair raw West Indian was quoted at 2s 9d. per gallon. Fair West Indian distilled oil of limes was selling at the end of the month at 8s. per lb. For annatto seed there has been no demand. At auction at the end of the month as many as 55 packages were offered but found no buyers. It was reported at the beginning of the month that tamarinds had advanced in price, and that 40 barrels of Antigua had been sold in bond at 35s.

THE WISLEY LABORATORY.

The Royal Horticulture Society's garden at Wisley in Surrey, England, is described in *The Field* for April 7, 1917, as having great capabilities. In addition to the experimental ground for fruit, vegetables, and flowers, it possesses a range of glass houses which are devoted to special cultures and trials, and the rock garden is one of the largest and best designed in the country. Wisley is therefore well equipped for training and teaching purposes, for the advancement of horticulture, and the society is in a position to accomplish great things. The latest addition is a range of buildings to serve as a laboratory for scientific research, and the society is to be congratulated on the picturesque character of the buildings. They not only add a feature of real beauty to the gardens, but they give promise of useful work. They are fitted with electric light and heated with hot-water radiators. The rooms are in four sections, botanical, chemical, mycological, and entomological. A large room is fitted as a library and herbarium, with cupboards for 80,000 sheets of dried specimens of plants of horticultural importance, and shelves for 8,000 books required for the immediate purpose of research, scientific periodicals, and so forth. The cost was £8,000.

Wisley is now our leading school of horticulture. Already a considerable number of young men have had the advantage of a course of training there. The war has, unfortunately, interfered with this department of the society's work, but in view of the great need of horticultural effort and of the importance of a proper knowledge of the arts of cultivation, it may be expected that, when the war is over, Wisley and other schools of horticulture will be taken full advantage of by the young men and women who desire to become efficient workers in the great and nationally important department of gardening.

The Salt Industry of the Turks and Caicos Islands.—In their report on an inquiry into the condition of the salt industry of the Turks and Caicos Islands the Committee appointed for that purpose summarize their recommendations as follows: (1) the establishment of a commercial agent to promote the sale of salt; (2) the necessity for co-operation; (3) the appointment of a supervisor or inspector; (4) the introduction of a banking system; (5) the erection of sheds to avoid wastage of product, and (6) the improvement of shipping facilities.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
June 28, 1917.

ARROWROOT—5d. to 6½d.
BALATA—Block, 2/9½ to 3/4; Sheet, 3/10½ to 3/11½.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, 70/- to 81/6;
Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
COTTON—Fully Fine, no quotations; Floridas, no quotations;
West Indian Sea Island, 41d. to 45d.
FRUIT—Bananas, no quotations; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
ISINGLASS—No quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations;
Otto of lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—11d. to 2/3.
NUTMEGS—7d. to 1/2.
PIMENTO—3¾d.
RUBBER—Para, fine hard, 3/-; fine soft, no quotations;
Castilloa, no quotations.
RUM—Jamaica, 7/-.

New York.—Messrs GILLESPIE BROS. & Co., July
3, 1917.

CACAO—Caracas, 12½c. to 12¾c.; Grenada, 12c. to 12¼c.;
Trinidad, 11¾c. to 12c.; Jamaica, 10½c. to 11¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$42.00 to
\$43.00; culls, \$24.00 to \$25.00.
COFFEE—Jamaica, 9¾c. to 11½c. per lb. 1
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 80c.; Antigua and Barbados, 70c.
to 80c.; St. Thomas and St. Kitts, 65c. to 75c. per lb.
GRAPE FRUIT—Jamaica, \$2.00 to \$2.50.
LIMES—\$6.50 to \$7.50.
MACE—39c. to 43c. per lb.
NUTMEGS—20c. to 21c.
ORANGES—\$1.75 to \$2.75.
PIMENTO—6¼c. per lb.
SUGAR—Centrifugals, 96°, 6.52c; Muscovados, 89°, 5.66c.;
Molasses, 89°, 5.50c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., July 20,
1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.50 to \$13.00.
COCO-NUT OIL—\$1.10 per Imperial gallon.
COFFEE—Venezuelan, 12c.
COPRA—7c. to 7¼c. per lb.
DHAL—No quotations.
ONIONS—\$7.00 per 100 lb.
PEAS, SPLIT—\$11.00 to \$12.00 per bag.
POTATOES—English, \$6.50 per 100 lb.
RICE—Yellow, \$8.50 to \$9.00; White, \$6.75 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., July 24,
1917.

ARROWROOT—\$10.00 per 100 lb.
CACAO—\$12.00 per 100 lb.
COCO-NUTS—\$26.40 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure,
no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$4.50 to \$5.00.
PEAS, SPLIT—\$12.00; Canada, no quotations.
POTATOES—\$7.25 to \$9.50.
RICE—Ballam, \$10.00 to \$10.50; Patna, no quotations;
Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$4.50 to \$5.00.

British Guiana.—Messrs. WIETING & RICHTER; Messrs.
SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND- BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'badon		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



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Scientific and Industrial Research.

THE war has directed attention, as never before, to the intimate relations between science and modern industry, as well as to the imperative necessity for fostering these relations, and, in a foreword contributed to a book on Warfare Work, the British Premier observes: 'It is a strange irony, but no small compensation, that the making of weapons of destruction should afford the occasion to humanize industry. Yet such is the case. Old preju-

dices have vanished, new ideas are abroad; employers and the State are all favourable to new methods.' In the work of reconstruction at the conclusion of peace, co-ordination of science with industry, and the utilization of the dependence of modern civilization on science will be powerful agents. The British industrial world is, by degrees, coming to see that the limits of development attainable by accumulated experience have been reached, and that empirical facts are not a safe or sufficient basis for full development in agriculture or in any other industry. Research is now regarded by those who have not a narrow conception of life as essential to evolve both facts and the fundamental principles underlying facts.

Up to the present the idea has prevailed to too great a degree that pure science or research, and industrial or applied science are antagonistic. Those engaged in industrial pursuits have been inclined to consider that because pure science deals largely with principles it is necessarily impractical. As was pertinently remarked many years ago by a distinguished scientist, applied science is nothing but the application of pure science to peculiar problems. How closely allied they are is well illustrated by the research work of Pasteur, resulting in the discovery of the germ theory, the discovery of which prevented the extinction of the silk industry in France and was instrumental in eradicating anthrax. Pasteur's theory was also practically applied with beneficent effect to humanity in surgical operations by Lister, who, by an inspiration of genius, perceived the analogy between the changes occurring in the fermenting liquid and the suppuration in an open wound. There is no reason, therefore, why pure and applied science should in the future remain divorced; the benefits

from their closer alliance will be incalculable. Pure science in the past has owed much to observations and suggestions external to the laboratory and study, and it will be for the good of mankind at large if the relationship of scientists be so ordered that they receive a stimulus of a wider and more practical outlook than is attainable under the limitations of an academic system of syllabus and examination. As the future will be an age of specialization and co-ordination, it is an important point that the specialists be men actively engaged in the work which is their specialty. It is the duty of men of science and of leaders of industry to exert themselves to the utmost to secure due recognition and participation of science in the gigantic problems of national and international readjustment with which the world will shortly be confronted.

The Report for 1915-16 of the Committee of the Privy Council for Scientific and Industrial Research states clearly and definitely that pure science is the necessary precedent of industrial applications, and efforts are being made on the part of British industrialists to promote original research both by individual and co-operative assistance. In the United States of America there has been an earlier recognition than in England of the large part played by the systematic application of science in the rapid progress of German trade. The Mellon Institute of Industrial Research, the Carnegie Institution, and the Rockefeller Institute, all of which have been founded in the present century, are magnificent instances of the recognition by private men of the supreme necessity in the advance of civilization for encouraging pure science in the broadest and most liberal manner, while the Federal Department of Agriculture is alive to the same need, as is shown by the fact that nearly 2,000 trained specialists are engaged in its laboratories in scientific investigation and research. The scheme of organization of the Rockefeller Institute is of special interest, as it is regarded by many as ideal for a scientific institution established for a specific field of research. The experience of the institute in regard to scientific investigation is that the best method is to map out a field in which the most pressing problems arise; then to obtain the best man available in each branch, and to allow him to associate with himself collaborators to attack the problems in the most effective manner. Many of the leading industrial firms in the United States have also established research laboratories on an extensive scale; one company, for instance, which specializes in the production of serums and toxins, having a scientific staff of more than sixty graduate chemists and bacteriologists.

In no sphere of industry, perhaps, is the union of science and practice, of head and hand, of such consequence as in agriculture. The publication by the English Board of Agriculture of a comparative study of British and German agriculture has served to direct attention to the lower producing power of the former, and the far smaller efforts devoted to promoting agricultural research; and it is stated that the great advance achieved in Germany during the last quarter of a century is largely due to the co-operation of science with practical farming. Throughout the present war, the agricultural colleges and experiment stations have rendered useful service, and have demonstrated more convincingly than ever the dependence for development of agriculture upon research. Unfortunately, research facilities have been disproportionate to the need, owing to science having not been regarded in its true light in the past. It is to be hoped that the new conditions will do much to strengthen and stimulate, throughout the Empire, development of scientific agriculture, for if the Empire is to meet with success the problem of becoming self-supporting as regards foodstuffs, it is imperative, so far as science permits, to make our agricultural knowledge exact by learning by research the action of the laws which find application in agriculture.

DEPARTMENT NEWS.

Mr. F. H. Watkins, I.S.O., having been requested by the Secretary of State for the Colonies to act as Colonial Secretary of the Leeward Islands, has left for Antigua to take up that office. The Governor of Barbados has consented to allow the Reverend C. H. Branch, B.A., to perform the duties of Scientific Assistant.

Arrangements are in progress to enable Mr. S. C. Harland, B.Sc., Assistant Agricultural Superintendent, St. Vincent, to carry out investigations with Sea Island cotton, under the direction of the Imperial Department of Agriculture. Provision for this service is being made by the Department of Scientific and Industrial Research, lately established by the Imperial Government.

In 1916 an Act was passed in the Imperial Diet of Japan, to grant subsidies to the amount of 2,000,000 yens (yen = 2s. 0½d.) spread over a period of ten years to the establishment of a scientific laboratory in Tokio, and the Imperial Household has also decided to donate 1,000,000 yens to the undertaking. The laboratory will be completed in ten years time, and it is intended, as is stated in *The Board of Trade Journal*, Vol. XCVII, p. 669, that researches in connexion with electrical and electro-chemical industries, chemical and other products industries, and processes will be carried on.

JAPANESE SUGAR INDUSTRY.

A considerable development has taken place in the sugar industry of Japan. In Formosa, too, the expansion has been striking. In Japan itself, as a result of Government assistance, there has been an increase in sugar production, the average output for the past few years having been 1,250,000 piculs. With sufficient protection and State aid the Japanese output may eventually rise to 2,000,000 piculs. Of the present output, 80 per cent. is black sugar, and 20 per cent. is a very low grade brown sugar, but the authorities are taking steps to secure the production of centrifugal sugar. [A picul = 133½ lb.]

The chief part played by Japan proper in the sugar industry is in refining. The first refinery was established in 1896, and according to a report from the British Embassy at Tokyo, there are now eight refineries with a capacity of 1,300 tons per day. Exports from Japan consist almost wholly of refined sugar, the average annual export of which in 1912, to 1913 and 1914 amounted to 1,300,000 piculs, valued at 12,000,000 yen. The principal market for Japanese refined sugar is China, where it is said to be gradually supplanting Hong Kong sugar. [A yen = 2s. 0½d.]

ALL RECORDS BROKEN.

The development of the sugar industry in Formosa was taken in hand by the Government in 1902, and regulations were promulgated for its encouragement. As a result of generous Government assistance which took the form of the employment of experts, the establishment of an experimental station, subsidies, and the loan of machinery, the production of sugar in Formosa increased rapidly. Production prior to 1902 had never reached 1,000,000 piculs; but by 1906 it had risen to 1,280,000 piculs, and by 1910 to 3,775,000 piculs.

In 1916 all records were broken, the estimated output being 6,200,000 piculs of centrifugal sugar, and 700,000 piculs of brown sugar.

The first charter for the erection of a modern sugar mill in Formosa was granted in 1901, and there are at present fourteen companies owning thirty-seven crushing factories, with an aggregate crushing capacity of 27,240 tons per day of twenty-four hours. The total paid up capital of these companies amounts to 56,175,000 yen. Although the export of sugar from the island to foreign countries was considered to be a matter of secondary importance, attention is now being turned to the export trade, the supply having overtaken the home demand. (*The Pall Mall Gazette*, May 29, 1917.)

GREEN DRESSING AND FALLOW.

It has been observed that the productive power of arid and semi-arid soils is more often limited because of an insufficient supply of moisture, or because of improper physical and biological conditions than because of a lack of certain fertilizing elements. In more humid districts these defects may generally be corrected by the use of systems of crop rotation, but under arid conditions rotation is difficult owing to the limited number of crops adapted to those circumstances.

To overcome this deficiency of crops, a year of fallow, and the addition of organic matter to the soil by cover crops have been advocated. The year of fallow is recommended primarily as a moisture-conserving measure to make possible an adequate supply of moisture in the soil for a maximum crop at all times, while the cover crop is recommended as

a means of maintaining the supply of humus. In order to secure information as to the value of these treatments, a series of experiments, reported in *Bulletin No. 270 of the Agricultural Experiment Station* in California, has been conducted on the University Farm at Denis, and the results obtained in these investigations, especially as to green dressings, should be of interest to West Indian planters. It has been shown that the marked decline in wheat production in California has been caused by the deleterious effects of continuous one-sided cropping, together with inadequate cultivation. The year of fallow is one of the most effective means of retaining the productive power of semi arid soils, and although the use of green manure crops increases the productivity, it does not do so to the same extent as the bare fallow, and the organic matter added to the soil by these crops appears to be practically lost by oxidation in the following year. Moreover, as the use of cover crops, even if they be legumes, does not seem to increase the content of humus or of humus nitrogen to any appreciable extent, their favourable effects so frequently observed must be attributed to other causes than to an increase of humus in the soil.

WASTAGE IN MANURE.

One of the chief uses for keeping cattle on an estate is to obtain manure, and there is great loss if the manure is wasted. On many estates, for want of sufficient labour or for other reasons, the manure is allowed to remain in the pen until most of its richest properties are lost, but a certain percentage of waste is avoided if the manure is mixed with the litter of cattle or with earth. Some interesting experiments, reported by the late Dr. N. H. J. Miller in the *Annual Report of the Chemical Society*, for 1916, on the effect of straw in farmyard manure, showed that, whilst a mixture of cow and horse manure without straw lost more than 5 per cent. of its nitrogen in four weeks, the addition of 8 per cent. of wheat straw resulted in gains of nitrogen amounting to 3.7 to 4.8 per cent. In each case there was a great increase in the number of bacteria, especially when straw was added. Azotobacter was not identified; it was, however, found that the activity of the nitrogen-fixing organisms was greatest in the manure with straw.

In another series of experiments, made to ascertain the effect of different kinds of litter, it was found that all the manures, with or without litter, gained nitrogen in the first four weeks. From the fourth to the eighth there was a fairly rapid loss of nitrogen, so that in the end all the manures contained less nitrogen than at the commencement.

The amount of nitrogen as ammonia, which varied from 0.7 to 1.7 per cent. of the total, showed a tendency to increase in the second week, after which there was a fall, but the proportion of ammonia was never very large. The nitrogen soluble in water, representing 41 to 48 per cent. of the total, decreased rapidly during the first four weeks, and the total losses amounted to 70 to 90 per cent. of the initial quantity.

Cacao planters in the West Indies are having to face strong competition in this article from the Gold Coast. According to late Market Reports from Messrs. Gillespie Bros & Co. the prices of cacao continue to decline owing to the very large importations from Sanchez and Accra.

THE MAKING OF COCO-NUT BUTTER.

Owing to the high price of butter, numerous inquiries are being made in Jamaica and elsewhere how to make coco-nut butter. At present, coco-nut butter is largely used in Great Britain and France in place of dairy butter, and even before the war it was well known in Germany. It might be used wherever dairy butter is used. The process of making butter is described in the *Journal of the Jamaica Agricultural Society* of February 1917, as follows: Grate or grind in a mill the meat of the nut as fine as possible, and for the meat of each average nut add a pint of boiling water. Put this in a press, so that the milk can be squeezed out separate from the pulp. This milk can be used in place of cow's milk for any purpose, and is especially good with stewed fruit. To make butter, this milk can be separated in a separator, or allowed to stand in a pan to let the cream rise, which it should do in about the same time as the cream in cow's milk. The cream can be set to ripen, and be subsequently churned in the usual way. The whole process is in every respect the same as in making dairy butter. Wash out the butter-milk and add salt to taste. As a rule, this butter is white, and annatto colouring can be added. According to the size of the nuts, it should take six to ten nuts to make a pound of butter. The churning should be done in a cool temperature, say, between 60 or 70 degrees.

ONION INDUSTRY IN MONTSERRAT.

The report on the working of the Montserrat Onion Growers' Association for the year 1916-17 affords interesting reading, for it shows the benefits to be derived by co-operative association even when practised on a small scale.

The method of working followed on the same lines as in the previous season, and the nett return to the members shows a decided improvement on last year.

Twenty-one members joined the Association in this season, compared with thirty in the previous year, the falling off in membership taking place only amongst small growers.

The local Government again agreed to finance the Association to the extent of £200 on a 3 per cent. basis, £85 of this only being used.

Four additional racks were added to the existing series at the Onion House at a cost of £3 9s. 6d., which amount was charged to current expenses. The Onion House was opened to deal with the crop on January 17, and closed on April 14, so that the work there was continued just one month longer than in the previous year.

Members were, as in the previous year, allowed to deliver onions either on strings or loose, at their convenience, and, except in very few instances, newly reaped loose onions without the tops were delivered. A stock of barrels was laid in with a view to catering for the Barbados market, where onions on strings are preferred, but the deliveries of onions on strings were insufficient to make use of more than a portion of these, and, in any case, in the absence of better methods of stringing the onions, it is inadvisable for the Association to continue this method of shipment.

Considerable expense was saved at the Onion House by dispensing with the grading table, the onions all being graded into three sizes by the eye, a method that is found to work quite satisfactorily.

The total amount of green onions delivered was 55,857 lb. compared with 55,022 lb. in the previous year, and as the total amount of cured onions actually shipped was 45,140 lb., there was a loss in handling of 19 per cent. compared with a loss of 17 per cent. in the previous season. The extra loss

on handling is no doubt due to the considerably larger proportion of onions sent in in a green condition, the stringing of onions being more general in the previous season.

The onions from one district were penalized to the extent of 10 per cent. owing to the excessive loss from bacterial rot after delivery, and this reduced the total nett deliveries of green onions to 54,344 lb.

The weight of onions destroyed in the building by bacterial rot was 3,294 lb. compared with 4,239 lb. in the previous season, the drier season evidently resulting in a reduced tendency to develop this disease.

The shipments of onions totalled 812 crates and 19 barrels. The following figures show the destination of the various shipments, and the approximate average nett price per pound received, c.i.f.:—

Destination.	Nett return.	Approximate nett return per pound.
BARBADOS.		
16 barrels } 461 crates }	\$1,575.03	5½ cents
TRINIDAD.		
141 crates	\$ 409.68	5 "
GUADELOUPE.		
51 crates	\$ 160.40	5½ "
ST. LUCIA.		
42 crates	\$ 105.00	4½ "
DOMINICA.		
12 crates	\$ 33.74	5 "
CANADA.		
105 crates	\$ 207.23	3½ "

The following statement shows the receipts and expenditure on the year's working:—

EXPENDITURE.		£	s.	d.
Total working expenses		184	3	0
1st payment for onions at 1c. per lb.		113	4	4
Bonus on onions at 2.39c. per lb.		270	12	1
6% on profits to Association		17	5	0
		£525	4	5
RECEIPTS.		£	s.	d.
On account of onions shipped		516	7	6
Onions sold at Onion House		5	13	11
Sale of 21 empty barrels		2	12	6
Members' subscriptions		10	6	
		£525	4	5

AGRICULTURAL EDUCATION AND RESEARCH.

In an able article entitled 'The German Challenge to British Agriculture', which appears in the *Journal of Agriculture of Victoria*, Vol. XV, Part 4, p. 128, the Agricultural Superintendent of the Colony considers that apart from her economic policy, which has been systematically directed to produce sufficient food-stuffs within her own territory to feed her rapidly increasing population, Germany's progress may be largely attributed to her comprehensive system of agricultural education and research.

Despite her unfavourable climate and average quality of soil, German production—measured in terms of aggregate output per farm, or average yield per acre—stands at the head of the agricultural countries of the world. The aim of the scheme of education was the union of science and practice, and perfection in technique. Germany organized a scheme of education which provided for:—

(1) The *adult* farmer, by the establishment of legally constituted Chambers of Agriculture, a Central German Agricultural Council, and by providing experimental stations, peripatetic instructors, and literature relating to every phase of plant and animal husbandry.

(2) The *youth*, by means of graduated agricultural instruction extending from the schools to the Agricultural Colleges and the University.

(3) For *research*, by providing well equipped Agricultural Experiment Stations throughout Germany, and several Departments of Agriculture at the Universities.

The object of these institutions was to prosecute research work, make a thorough study of methods and principles, and train for the future agricultural leaders of Germany.

Britain and her Dominions cannot afford to do less than what Germany has done. Indeed, if Britain is to re-establish her leadership in agriculture, her organization in agricultural education must be even more thorough than Germany's.

Government grants for agricultural institutions in Germany have hitherto been on a much more liberal scale than in Britain. The expenditure on agricultural instruction in Prussia alone was £484,000 in 1910. The total expenditure in agricultural education in England and Wales for the same year was £117,000.

The ultimate objective of any scheme of agricultural education should be to increase the agricultural output of the State. This may be achieved (1) by making the present generation of farmers more efficient by diffusing among them a knowledge of the scientific principles underlying their industry; (2) by giving the farmers of the future, i.e., the boys and youths of the present day, a sound training in agricultural science and practice. All progressive agricultural countries provide organizations for achieving both these objectives. The agricultural output of a state may be temporarily stimulated by tariffs, or fixing of prices for products, bonuses, and other artificial aids; but the only way to secure a permanent increase in output from the land is to improve the farming methods of a country, and apply the teachings of science to its agricultural practice.

Provision must be made for (1) the application of existing knowledge in all branches of plant and animal industry; (2) the acquirement, by means of experiment and research, of new knowledge which will form the basis of future improvements in the practice of agriculture.

The application of science to agriculture, however, requires a body of trained agricultural scientists; some to engage in research work and attack new problems, others to apply existing knowledge to local problems, and to show how

the adoption of correct farming methods inevitably increases the output.

A body of trained workers is required to act as evangelists who will spread the gospel of better farming methods, and transform those who, at present, farm by rule of thumb into active apostles of the profitable practices dictated by the achievements of science.

SCIENTIFIC AND INDUSTRIAL RESEARCH IN CANADA.

In June 1916, a Committee of the Privy Council of Canada, consisting of the Minister of Trade and Commerce as Chairman, and of the Ministers of the Interior, Agriculture, Mines, Inland Revenue, and Labour, was formed to have charge of all measures to foster the scientific development of Canadian industries, in order that during and after the war they may be in a position to supply all Canadian needs, and to extend Canadian trade abroad. Under this Committee has been constituted an Advisory Council for scientific and industrial research, composed of eleven members, representative of the scientific, technical, and industrial interests of Canada. This Advisory Council has been charged with the following duties:—

(a) To ascertain and tabulate the various agencies in Canada which are now carrying on scientific and industrial research in the Universities and Colleges, in the various laboratories of the Government, in business organizations and industries, in scientific associations, or by private or associated investigators.

(b) To note and schedule the lines of research or investigation that are being pursued by each such agency, their facilities and equipment therefor, the possibilities of extension and expansion, and particularly to ascertain the scientific manpower available for research, and the necessity of adding thereto.

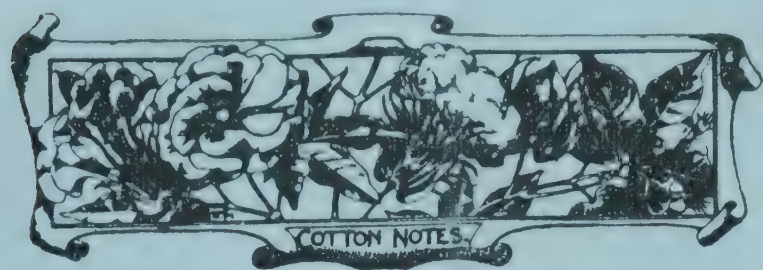
(c) To co-ordinate these agencies so as to prevent overlapping of effort, to induce co-operation and team work, and to bring up a community of interest, knowledge, and mutual helpfulness between each other.

(d) To make themselves acquainted with the problems of a technical and scientific nature that are met with by our productive and industrial interests, and to bring them into contact with the proper research agencies for solving these problems, and thus link up the resources of science with the labour and capital employed in the production, so as to bring about the best possible economic results.

(e) To make a scientific study of common unused resources, and waste and by-products of farms, forests, fisheries and industries, with a view to their utilization in new and subsidiary processes of manufacture, and thus contribute to the wealth and enjoyment of the people.

(f) To study the ways and means by which the present small number of competent and trained research men can be added to from the students and graduates of sciences in universities and colleges, and to bring about in the common interest a more complete co-operation between the industrial and productive interests of the country and the teaching centres and forces of science and research.

(g) To inform and stimulate the public mind, in regard to the importance and utility of applying the results of scientific industrial research to the processes of production, by means of addresses to business and industrial bodies, by the publication of bulletins and monographs, and by such other methods as may seem advisable.



COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland of Liverpool, write as follows, under date July 10, 1917, with reference to the sales of West Indian Sea Island cotton:—

West Indian Sea Island cotton is eagerly enquired for and prices continue to harden. Good, clean Leeward Island cotton is worth 48*d.* per lb., and Barbados is also worth this figure.

THE INDUSTRIAL USES OF COTTON.

The industrial uses of cotton are rivalling its use for clothing and household fabrics. Twenty years ago the use of cotton in industry was scarcely dreamed of; to-day, excluding explosives, some 4,000,000 bales are probably taken up for purposes outside the clothing business.

The manufacturers of motor tyres in America alone, it is stated in the *India Rubber Journal* of June 9, 1917, are consuming 500,000 bales of long staple cotton a year, while belting, fire hose, and electrical insulation will call for as much more. There are many industrial uses for cotton cloth and heavy canvas, such as aprons and elevators for harvesting machines, bags for grain, cement, sugar, and flour, tarpaulins and canvas for steamships, its use as insertion in a large variety of rubber goods, and the railway uses for air-brakes, upholstery, and other purposes, that will approximate 2,000,000 bales. Cordage takes 100,000 bales. In normal years the estimate for absorbent cotton and surgical bandages is 15,000 bales. There are no available figures for the present consumption.

One cannot touch industry at any point without coming in contact with cotton in some form or other. The celluloid and artificial silk industries, and the artificial leather industry are all dependent on it.

Foreign Islands and British Agriculture.—

At a meeting of the St. Croix Colonial Council, held on June 11, permission was given, as stated in the *Avis* of June 13, 1917, for the introduction and discussion of Council Bill, No. 5, granting an amount not exceeding \$500 to defray the travelling expenses of a commission of two, one a planter the other an engineer, to visit Antigua for the purpose of investigating the erection and working of a corn mill, and for other purposes in connexion with the raising of food stuffs in the island for the account of St. Croix Immigration Fund. In the discussion on the Bill, which was passed, it was explained that the Government had requested the Planters' Association to find means in time for providing the islands with foodstuffs, and, as the main foodstuff of St. Croix was corn meal, it had been recommended by that body that the first step to be taken was for a Commission to visit Antigua to study the working of the corn mill which had been established with good results in that island.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. Beyond plant distribution, which consisted of 4,525 lime seedlings, 71 budded citrus, 5 grafted mangoes, 450 shade trees, 50 Congo coffee, 28 nutmegs, and 54 miscellaneous, together with 372 packets of vegetable seeds sold, the report of the Curator, Mr. Joseph Jones, for the month of June supplies little for comment. The prospects of the lime crop are said to be good, and a visit by Mr. W. Nowell, Mycologist on the Staff of the Imperial Department, on June 28, to investigate the prevalence of bracket fungi on lime trees, is recorded. Rainfall for the month was 15.34 inches.

NEVIS. Mr. W. J. Howell, the Agricultural Instructor, in his report for the month of June, states that the crops on the plots in the Experiment Stations made good progress in consequence of the favourable showers. A supply of Paris green had been secured, and stored at the Experiment Station for sale to peasant cotton growers. An importation also of 5 tons of Paris green had been made by Mr. Wildy for general local sale. Plant distribution during the month included the following: cotton seed 306 lb., sweet potato cuttings 51 bags, cassava cuttings 400.

The young canes throughout the island had much improved since the rains, but some of the fields were somewhat irregular. About 2,500 acres of cotton were planted during the month. The germination, on the whole, was good and the fields were all doing well. In some localities difficulty was experienced in keeping the fields clean on account of shortage of labour. Cotton worms made their appearance in a few fields, but very little damage was done, as they were kept in check by the use of poison. A fairly large acreage of sweet potatoes and peas was planted during the month, and the outlook, on the whole, was favourable. At a meeting of the Agricultural and Commercial Society held on June 14, the question of transportation of canes across to St. Kitts was discussed, but it is not likely, says Mr. Howell, that anything will be done to meet the 1918 crop. The rainfall for the month was 6.73 inches; for the year to date, 19.24 inches.

GRENADA. From reports of the Agricultural Instructors for the month of May, recently received at this Office, it is seen that the usual visits to the country districts were made, and instruction to the peasants continued on similar lines as heretofore, occasion being taken to impress the necessity of increasing the cultivation of ground provisions and native food crops generally. With a view to meeting the possibility of a food crisis—to which the peasantry are said to be as wide-awake as they can be—more lands are being brought under cultivation than for many a year past.

As regards the crops cacao trees were blossoming, sugar manufacture was still in progress, the estates in some districts closing operations with a marked decrease on last year's output. Ground provisions of all descriptions were scarce; live stock continued to be scarce also, and there appeared to be no organized effort to increase the number in the community.

A satisfactory number of entries were made in the provision gardens competition in the parishes of St. David, St. Andrew, and St. Patrick, and in the cotton competition in Carriacou.

Regarding pests and diseases, canker and thrips were reported on estates in St. Patrick's and St. David's, respectively.

The Superintendent of Agriculture in his report for the month of July states that, in the Experiment Stations, planting operations were delayed by dry weather until June, but were completed early in July. The following plant distribution from the Botanic Gardens is recorded: lime seedlings 8,850, budded orange 12, grafted mango 16, timber 23, ornamental 41; also 1 lot cane plants and 3 packets seeds. Routine work progressed satisfactorily. Regarding staple crops, Mr. Moore states that the July rains caused some dropping of young cacao pods; the trees, however, were still flowering heavily, but the crops would be late. The main lime crop would be late through the dropping of the first fruits during the dry weather. The condition of ground provisions was satisfactory. There had been sporadic outbreaks of caterpillars on corn and peas, but no serious damage had been done. There had been a continuation of work on the native food crop campaign, and public demonstration with spraying apparatus in St. David's. Arrangements for prize holdings competitions in Grenada and Carriacou were still in progress. The weather was exceptionally wet, the rainfall recorded at Richmond Hill being 17.08 inches in twenty-six days, while 28.35 inches at Belvidere and 31.47 at Plaisance were registered in twenty-nine days. At Carriacou 16.10 inches was the record, also in twenty-nine days.

ST. LUCIA. According to the Agricultural Superintendent the ordinary work in the Experiment Station has been continued during July. We note that seeds of *Coffea robusta* have been sown. There have been distributed 13,250 lime plants and 40,500 potato cuttings, 61 ornamental and decorative plants, and 73 packets of vegetable seeds. The condition of the cacao crop is stated as normal, the sugar crop was growing well, and large areas have been planted up in limes. Dr. J. C. Hutson, Entomologist on the Staff of the Imperial Department of Agriculture, paid a visit of two weeks to the island for the purpose of making observations in connexion with certain pests.

Mr. C. Williams, Entomologist in charge of the frog-hopper campaign, attached to the Trinidad Department of Agriculture, visited the Cul-de-Sac Valley in connexion with this pest; no signs of its presence were found.

The Imperial Commissioner of Agriculture landed in St. Lucia twice during the month, and discussed matters of agricultural interest with the Agricultural Superintendent. A large amount of travelling agricultural work was done during the month. Visits were made to eight estates and to a number of small holders. The crop of limes from peasant cultivators is now coming into the Government Lime Juice Factory. Eighteen casks of concentrated juice await shipment.

DOMINICA. Mr. Joseph Jones, Curator of the Botanic Station, states that in the lime experiment plot green dressings were sown during July, and the application of manures was completed. In the cacao experiment plot the trees were pruned, and the plots were manured completely. Thirty-six bags of cacao and 2 bags of kola nuts have been shipped to London. A total number of 8,152 plants have been distributed during the month consisting of limes 7,850, eucalyptus 210, budded citrus 85, grafted mangoes 7, vegetable seed 169 packets. Heavy squalls were experienced during the first week of the month, and again on the 18th instant, which brought down considerable quantities of immature lime fruit. The local price paid for green limes has dropped from 8s. to 5s. per barrel. During the month 22,000 cane plants of good seedling varieties have been imported for some estates. The green scale was in evidence on lime trees on a number of

estates, and much black blight was also present. The Permanent Exhibition Committee has shipped 41 boxes of limes and 2 boxes of oranges to London for the use of wounded soldiers in hospital. The month has been wet; the total rainfall being 13.7 inches.

MONTSERRAT. The experiment plots in the Station were all in good order according to Mr. Robson in his remarks for the month of July. Seed of onions from Kew and from California have been sown; the former are germinating splendidly. The plants distributed from the station have been 2,660 bay trees, 900 limes, 21 fruit trees, together with 117 lb. of seed corn, and 20 packets of beans. Profuse growth has been made by the bay trees in the experiment plots as the result of rains in the past two months. The continued damp weather and high winds have been responsible, probably, for some damage to the cotton crop, but the area planted in cotton will most likely be a record one. Two more ginneries will commence work in the present season. The price offered for seed-cotton from small growers is 8d. per lb. Thanks to the rains of June and July, the limes now being reaped are of good size and appearance. Cotton worms have appeared in a few places, and dusting has been necessary. A stock of about 1,000 lb. of Paris green is on hand at the Botanic Station for sale to small planters. Observations have shown the association of cotton stainers with silk-cotton trees that have borne pods, while the connexion between the insects and malvaceous herbs is not so definite. A considerable quantity of the leaves of *Datura Metel* have been collected and dried, to forward to the Imperial Institute for examination. The question of Agricultural Credit Banks has been discussed at a meeting of the Agricultural Society.

ANTIGUA. The sugar-cane plots at Skeretts have been planted with green dressings. Plants distributed from the station consisted of 662 bay trees, 25 coco-nuts, 89 miscellaneous economic, 65 decorative, 33,600 sweet potato cuttings, and 377 lb. cotton seed. The general condition of the Botanic Garden is very good. With regard to the cane crop the young plants require some more rain; the young cotton crop has made normally good growth. A large quantity of corn has been planted in the island, a part of which will be reaped during the next few weeks. There will be a second payment of profits in connexion with onions received from planters by the Antigua Onion Growers' Association, which should be considerably better than that of last year. During the month of July, 4.22 inches of rain fell, making a total for the year of 21.17 inches.

ST. KITTS. Among the work carried on during the month of July at the Experiment Station by Mr. F. R. Shepherd, the Agricultural Superintendent, has been that of experiments with reckoning flowers on plants in cotton manurial plots, and measuring the growth of joints of young cane plants. As regards the cane cultivation, the crop for 1917 is now practically all taken off; the growth of the young canes for next crop is very backward on many estates, there having been no heavy rains. The cotton crop is well advanced, and the plants are bolling well; so far there has been no appearance of the cotton worm or any other pest. The cotton in the experiment plot at La Guérite is very promising. At a meeting of the Agricultural and Commercial Society held on July 9, notes were read by the Acting Chemical Assistant on the food value of white velvet beans. There was a discussion on means to be adopted to meet the shortage of imported foodstuffs. Rainfall for the month was 2.29 inches, making 19.78 inches for the year.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue draws attention to one of the most pressing questions of the age, namely, the relations between science and industry.

The first article under Insect Notes deals with insect pests in British Guiana; the second describes methods employed in St. Vincent for the destruction of the cotton stainer pest.

On page 269 there appears a review of a book of interest to West Indian agriculturists.

A report on the progress of the Montserrat Onion Industry will be found on page 260.

Goa or Manila Bean.

In the *Agricultural News*, Vol. VI, p. 266, reference was made to a trial in Jamaica of the Goa or Manila bean (*Psophocarpus tetragonolobus*), and in the Report of the Agricultural Department, St. Vincent, for the year 1907, mention is made of the plant as growing in the Experiment Station. In the report of the Agricultural Department, Dominica, just issued, the Superintendent mentions that it was introduced into Dominica about fifteen years ago, but that it is no longer grown there. As both the tubers and green pods are valued for food in India, it seems that it would be desirable to reintroduce this plant into the West Indies.

The Commissioner of Agriculture will be glad to be informed if any one in the West Indies has plants of this bean, or where seeds of it may be obtained.

Agricultural and Commercial Society, Antigua.

During the recent visit of the Imperial Commissioner of Agriculture, Sir Francis Watts, K.C.M.G., to Antigua, the Antigua Agricultural and Commercial Society gave an 'At Home' in the grounds of the Training School, in commemoration of the honour recently conferred on him by His Majesty the King.

After the arrival of His Excellency the Acting Governor and Sir Francis Watts, the Chairman of the Society welcomed the guests of the meeting, and referred in well chosen words to the long connexion which had existed between Sir Francis and the island of Antigua, and the work he had accomplished there in agricultural matters, especially with regard to the establishment of Sugar Factories, and the foundation of the Society which was now welcoming him as its guest. He voiced the sentiments of the whole community in congratulating Sir Francis on the honour the King had conferred on him.

His Excellency the Acting Governor added his congratulations to those of Mr. Cowley.

Sir Francis then replied, thanking the speakers for their appreciation and congratulations, and he added that he was rejoiced to find the condition of Antigua with regard to agricultural matters so much improved since the time when he returned from Jamaica to resume work in connexion with the Imperial Department of Agriculture.

The lady members of the Society efficiently attended to the refreshment of the guests, and a Gymkhana, organized by Mrs. Spooner and Mrs. Peters, added to the enjoyment of the afternoon.

Addresses on Agriculture in St. Kitts.

At a meeting of the St. Kitts Agricultural Society held on July 3, 1917, after the Assistant Chemist had read a paper on the feeding values of some legumes, with special reference to beans of the Stizolobium class, the Acting Government Chemist and Superintendent of Agriculture for the Leeward Islands supplemented Mr. Kelsick's paper with a brief sketch

of the history of the velvet bean family (*Stizolobium*), their uses in agriculture, and their value as a table legume, with personal notes on Trinidad experiences. Mr. Collens further addressed the society on agricultural activities in the West Indies, more particularly in Antigua.

Fish Meal for Stock Feeding.

At a recent meeting of the Aberdeen Chamber of Commerce the vice-President in the course of an address on Aberdeen's fishing industry, reported in the *Veterinary Record* of June 16, 1917, remarked that previous to the outbreak of the war nearly the whole of the valuable food for live stock in the form of fish meal had been utilized by German farmers. In 1914 well over 8,000 tons of fish meal was manufactured, and was exported to Germany where the farmers had discovered its value, and used it profitably in feeding stock, chiefly pigs, cattle, and poultry. It was no uncommon thing to find upwards of a thousand pigs being fattened on one German farm, and fish meal was one of the chief ingredients in the feeding stuffs. Most satisfactory results in pig feeding had been found where a judicious proportion of fish meal was used. Being very rich in albuminoids it was specially suitable for mixing with hay, straw, and almost all cereals and offals which contained a large proportion of carbohydrates. It was found to be considerably cheaper as a food unit than maize or bran. Carefully conducted experiments had dispelled the prejudice against fish meal entertained by some on the ground that it would give an unsavoury flavour to the flesh of animals fed upon it.

Irrigation as Crop Insurance.

Although an experiment in irrigating sugar-cane at Bendals estate, resulted, according to the Report of the Agricultural Department, Antigua, 1915-16, in the irrigated plot giving 4 tons of cane per acre less than the plot which did not receive water, this was probably due to the fact that the experiment was carried out in an exceptionally wet season. Even in regions which cannot be described as arid or semi-arid, irrigation may be of great value merely as a safeguard against unfavourable weather. Full crops are rarely obtained more frequently than once in five or six years, and 80 per cent. of failures may be assigned to droughts. Irrigation, therefore, eliminates the great element of chance from planting operations, and together with good drainage makes the planter nearly independent of the freaks and idiosyncrasies of the weather. We cannot control the weather, but the effects of drought are mitigated by giving crops abundant water by irrigation. When it is realized, as it should be, that water is the most essential chemical ingredient supplied to plants, and is needed for the transportation of all other ingredients through the plant, then will better provision be made to supply it in needful quantities when rain is withheld.

Food Economy.

With reference to the advertizing campaign now being carried on to promote economy in the consumption of bread, the Ministry of Food has issued a circular, dated May 22, 1917, which emphasizes the grave importance of attention to observing economy in this particular; and in an address to the Legislative Council of Antigua on May 29, 1917, the Acting Governor said: 'In the name of His Majesty the King I call upon all loyal subjects to waste nothing. It is only by conserving all our supplies and by increasing our local production to the utmost possibility that we shall be able to bear our part of the burden supported by our fellow subjects.' The Board of Agriculture in England has issued the following poster: 'Grow all the food you can. Save all the food you can. Do not give things men can eat, such as oats, barley, or maize, to farm animals, except when absolutely necessary. You must do with far less corn, meal, and cake than you have been accustomed to give to your live-stock. Ships cannot be spared to bring you the usual supplies. Every handful grown or saved is a bullet used to good purpose in the great fight for freedom and justice.'

Coaling in the West Indies.

In the *Colliery Guardian*, Vol. CXIII, No. 2,945, appears a long article dealing with the British and foreign coaling stations of the West Indies. In the introductory remarks it points out that these islands occupy a prominent position on the important shipping routes between Europe and the Mexican Gulf ports, Central America, and the Northern ports of South America, also on the route of vessels between the eastern ports of the United States and Canada, and the northern and eastern coast of South America. The prosperity of the British West Indies reached its zenith, it is stated in the article, about forty years back, the trade gradually declining to less than half twenty years later. A slight recovery has occurred since, which can be greatly extended in view of the resources available in the islands—cotton, sugar, and other industries, as well as petroleum. Moreover, the West Indian islands are on the direct route of the Panama Canal, a fact which cannot fail to have an important bearing on their future prosperity, provided that ample facilities are afforded for their development. With regard to their status as coaling stations, American coal has almost entirely secured the market owing to geographical position and the advantage possessed in distance and freight rates over supplies from England, but it is in the British interest to improve the coaling facilities at the islands, under the British flag, even if American coal has to be handled at those islands. It remains to be seen whether the policy of immediate action or of delay is adopted in the direction of meeting the competition not only of the coaling stations at the Panama Canal, but of stations at others of the West Indian islands, such as St. Thomas, which are possessions or under the protection of the United States, and in which great improvements have already been effected.

INSECT NOTES.

INSECT PESTS IN BRITISH GUIANA
IN 1916.

The following notes are taken from the general report by Mr. H. W. B. Moore, Entomologist for a group of estates in British Guiana, on the insect pests occurring on these estates during 1916. Previous reports have been reviewed in the *Agricultural News* from time to time, and the last one was referred to in the numbers for December 16 and 30, 1916 (Vol. XV, Nos. 382 and 383).

A NEW SMALL MOTH BORER OF SUGAR-CANE.

The present report contains among other features of interest an account of a small moth borer which was discovered by Mr. Moore in 1916. This insect had not been determined up to the time of the publication of the report, so that it may or may not be new to science. The caterpillar was found to have a wide distribution, which probably means that it has been a cane feeder for some time. It is new in the sense of having been only recently discovered.

This insect belongs to the same family, Pyralidae, as the two species of *Diatraea* moth borers occurring in British Guiana, but to a different sub-family. The *Diatraeas* come under the sub-family Crambinae, while the new borer belongs to the sub-family Phycitinae, which contains moths whose caterpillars have a variety of habits, some being borers in pods and the young shoots of certain plants, while others are predaceous on scale insects, and others again attack groceries.

As stated above, this pest is widely distributed, but it does not seem to be a persistent pest like the *Diatraeas*. Mr. Moore suggests that it probably has more or less definite times for appearing, but would be capable of doing considerable damage if it ever became really abundant.

Mr. Moore goes on to say that 'it attacks the shoot in a slightly different manner to the other small borers. It bores, as a rule, straight to the growing point, or the heart, and then merely eats out a small cavity instead of making a longitudinal tunnel. Its boring, nevertheless, has some resemblance to an incipient attack by *D. saccharalis*. The entrance hole is circular, and very small, and there generally proceeds from it a tube or gallery composed of earth and vegetable matter held together by web, thereby differing again from either of the other borers. This tube frequently becomes detached on cutting out the dead shoot, and then, the boring would certainly be mistaken for that of *D. saccharalis* by anyone not suspecting the existence of a third and very distinct borer. The caterpillars are very readily alarmed, and are wonderfully frisky, thumping about like fishes out of water. This trait constitutes a further difference between them and those of the other borers. There is another difference also in the readiness with which they leave their borings, when the shoots are cut out.'

The caterpillar is smaller than those of the other two small moth borers, and is green in colour with nine reddish longitudinal lines extending from the middle of the third segment to the end of the body. The first segment has a lateral brown spot and a dark-brown dorsal plate divided in the middle by a green line.

Mr. Moore has found that the caterpillars do not pupate within the boring, but outside, in a slight whitish cocoon.

The adult moths differ in colour according to the sex, the forewings of the male being grey with a large dull yellow

area. The forewings of the female are either grey with very little yellow, or are a plain dark grey. The hind wings of both sexes are a clean white with a slight brown border.

THE SMALL MOTH BORERS (*Diatraea saccharalis* and
D. canella).

These pests are still doing terrible damage and will continue to do so, Mr. Moore considers, unless more control work is done in the early stages of the sugar-cane. In connexion with the collection of egg-clusters, one of the suggestions made by Mr. Quelch, (a former entomologist for the above estates) was that the black, that is, parasitized egg-clusters should be taken from canes about to be cut, and should be distributed in young fields. Up to the present time this method has been carried out regularly on only two estates, but it is especially needed on estates where the fields are burnt off prior to cutting, as it would save large numbers of parasites for distribution in fields where they would do most good.

The collection of the egg-clusters of the small moth borer and the protection of the parasitized masses has often been referred to in the pages of the *Agricultural News*. A convenient way of carrying out the measures of control was described in the number for August 30, 1913 (Vol. XII, No. 296). A reference to this article, which was based on Mr. Moore's 1912 report, will show that by this method the escape of any hatching caterpillars can be prevented, and at the same time the emerging parasites are allowed to escape and continue their good work in the cane field. This method could be tried with advantage in those islands where the small moth borer is troublesome, and the simple apparatus described in the above reference could be set up in fields of young canes where the parasites are needed.

THE LARGE MOTH BORER (*Castnia licus*).

Mr. Moore found that the control work against the large moth borer was of an uneven nature, being very satisfactory on some estates, and rather the reverse on others; and an increase of infestation is to be expected on those estates where the collection of caterpillars and moths has been neglected.

THE SMALL BLACK HARD BACK (*Dyscinetus bidentatus*).

A fairly severe attack of this pest occurred on two estates between April and August, and less serious outbreaks were felt on other estates. The estates in question were prepared for the outbreak, having suffered in the two previous years, and a systematic collection of the beetles helped to reduce the damage. A fair number of eggs was collected on one estate. These are laid singly and loosely in the earth about the cane stools, and the grubs feed on decaying vegetable matter in the soil. It is the adult beetles that do all the damage by destroying the young cane shoots and often boring into the base of the plant. A closely related species *Dyscinetus barbatus* occurs in Antigua, St. Kitts, and Barbuda. The Scoliid wasp, *Tiphia parallela*, was found to be a parasite of *D. bidentatus* in British Guiana.

FROGHOPPER (*Tomaspis flavilatera*).

There was a severe outbreak of this pest on one estate where over four million adults and nymphs were collected and destroyed during the season. The adults were caught at the rate of several thousand daily by sweeping the drains in the worst infested fields with wide-mouthed nets. This was done on the advice of Mr. C. B. Williams, Entomologist in charge of Frog hopper investigations in Trinidad, while on a visit to British Guiana. The frog hopper was also destroyed in small numbers on a few other estates. After a careful and prolonged search Mr. Moore was able to find the egg of this

pest deposited in dry grass or cane-blades, or between dry cane-blades and the earth.

LEAF-FEEDERS.

The grass-looper (*Mocis repanda*) attacked the blades of young canes on several estates, and these outbreaks seem to occur annually after the coming of the mid-year rains in British Guiana. Outbreaks of this pest are experienced at long intervals in some of the West Indian islands, but it is generally considered to be kept in check by its natural enemies for long periods at a time. In these islands this insect is known as the Guinea grass moth or the Guinea grass worm, but the caterpillars are also very fond of Para grass, and occasionally attack other grasses. A good account of this insect can be found in the *Agricultural News* for June 5, 1915 (Vol. XIV, No. 342).

The rice worm (*Laphygma frugiperda*) also did a little damage to canes in British Guiana in 1916. This insect is known as the corn ear worm in the West Indies, and is called the fall army worm in the United States.

J.C.H.

TRAPPING OF THE COTTON STAINER

The following note has been furnished to this Office by the Agricultural Superintendent, St. Vincent.

Experiments have recently been made with the trapping and destruction of the cotton stainer (*Dysdercus delawarensis* Leth.), in the field in St. Vincent.

During last year's campaign against the silk-cotton tree, a noted food-plant of the pest, a small number of trees could not be cut down or limbed, because they were growing in situations where, if dealt with, they would have destroyed valuable crops; the trees, however, were barked, but notwithstanding this treatment three of them fruited before they could be felled or cut back. In each case a very large number of cotton stainers was attracted to the trees from the surrounding cotton districts. Mature insects and nymphs, as well as egg-masses, were present when the trees were dealt with.

The questions to be solved were: (a) how could the insects be prevented from scattering themselves about the districts, and (b) how could they be trapped and destroyed.

At the outset, heaps of silk-cotton pods were made under the trees and three times daily the insects which collected on them were killed with boiling water. As the pods became exhausted cotton-seed meal was substituted. Although this answered fairly well, on exposure it quickly lost its attractiveness to the cotton stainers. Cotton seed was next tried and this proved a striking success. It was soon noticed that the traps, of whatever kind used, needed shading to obtain the best results. If unshaded, the insects wandered away from them in the hotter periods of the day.

In previous experiments some of the traps were sprayed with strong kerosene emulsion. The cotton stainers on them were readily killed; there was this drawback, however, that the insecticide acted as a repellent, and fresh food material had to be put down after each spraying. Boiling water when readily available answered well, but in remote situations where the supervision of labourers was difficult, and the weather continued wet, there was always a danger that the work might be ineffectively carried out; with the result that the traps might actually become dangerous breeding places for the pest.

It has now been found that the difficulties experienced in the use of contact insecticides or boiling water can be largely overcome by the use of the gasoline torch. Mr. Lewis Punnett of Diamond estate, when assisting the Agricultural Department in the trapping and destruction of cotton stainers

which had attacked a silk-cotton tree in his district, thought that a torch might be usefully employed for destroying the pest on traps and in other situations where it might collect. He made an experiment, the results of which were very satisfactory.

The writer witnessed a trial of the torch made in the early morning of June 24 by Mr. Punnett, and the following is a brief description of the torch and its use.

The gasoline torch used was of American manufacture, made to hold 1 quart of gasoline. It had a horizontal burner giving a long clear blue continuous jet of flame under the pressure of the included force pump. The torch was easily carried in one hand, and the flame could be directed to any required point. The first cost of the instrument was about \$3.60.

When heated and lighted the torch was taken to traps of cotton seed placed under the shade of cacao trees surrounding a silk-cotton tree that had been destroyed when heavily infested with the cotton stainer. Care was exercised that the insects which had collected on the traps were not disturbed, because once they were molested in any way they quickly leave, and do not return for some hours.

When the traps were approached they were seen to be thickly covered with young insects. Few mature ones were to be seen at this time. The torch was applied, and in a few minutes most of the insects were killed. Relatively few escaped, and many of these were destroyed in different situations after the traps had been dealt with. The remains of insects burnt the previous morning were seen, and it is worthy of note here that the use of the torch does not destroy the effectiveness or attractiveness of the cotton seed or other bait of the traps, and the material can therefore be used for several days in succession, if the weather is not very wet. A small amount of moisture to soften cotton seed used for traps appears to be necessary to obtain the best results. It was found that the early morning was the best time to visit the traps, because a far larger number of insects are found then than at any other time.

With a torch of the size described several large traps and a very large number of cotton stainers can be dealt with daily in a few hours.

Taken altogether, the gasoline torch method of destroying the cotton stainer on traps has proved expeditious, efficient, and inexpensive, and its adoption is strongly recommended for the purpose indicated.

Gaseous Pressure in Growth.—In an interesting communication by Miss Ethel McLennan, B.Sc., on the influence of gaseous pressure on growth, contained in the *Proceedings of the Royal Society, Victoria*, 28 N.S., P.2, 1916, it is stated that contrary to the suggestion made in Sheffer's *Physiology of Plants*, namely 'a mere rise of gaseous pressure if sufficiently great will produce a retardation and ultimate cessation of growth,' the effect of the pressure made in the course of some experiments by Miss McLennan did not manifest itself immediately on the growth, so apparently the direct mechanical effect, if increasing the gaseous pressure upon turgor, is practically negligible as a factor which influences growth. Generally in one day retardation became noticeable, the amount of retardation being dependent on the pressure; broadly speaking, the greater the pressure the greater the retardation. It appears, too, that this retardation is not permanent, for the plant accommodates itself to the pressure, and the rate of growth is gradually raised. Whether the retardation caused by increased gaseous pressure is due to an increase in the partial pressure of the dissolved oxygen or not has still to be determined.



GLEANINGS.

The *Science Bulletin*, Vol. 2, No. 6, of the *Brooklyn Institute of Art and Sciences* is a contribution by Mr. George K. Cherr'e to the Ornithology of the Orinoco region, and is based chiefly on specimens in the collection of the museum in the Institute.

The Agricultural Superintendent, St. Vincent, reports that for the period from May 8, to July 31, 1917, there were sold from the Government Ginnery in St. Vincent, 10,776 lb. of selected and disinfected cotton seed for planting purposes.

Under an Ordinance No. 10 of 1917, to amend the Primary Education Ordinance, provision is made for industrial schools to be established in important centres of population in Grenada at which practical instruction in agriculture or industrial occupations will be given in accordance with such standards as may be prescribed.

In the *St. Vincent Gazette* of June 18, 1917, is published Ordinance No. 10 of 1917, providing a temporary increase in the customs duties on tobaccos, wines and spirits (except perfumed spirits, including bay rum or bay water and methylated spirits), of 25 per cent., and, on all other articles included in the first schedule of the original Ordinance, of 10 per cent.

In the final general Memorandum on the 1916-17 rice crop of British India, the total yield is estimated as 34,079,000 tons of cleaned rice compared with 32,824,000 tons in 1915-16, or an increase of 4 per cent. while the average yield per acre works out at 958 lb. as compared with 941 in 1915-16 and 756 lb. in 1914-15.

Two cases of tuberculosis in the horse are reported in the *Veterinary Record* of June 9, 1917. The symptoms in each case were much the same, losing flesh, poor appetite, and dulness, with a temperature never below 101.3. When tested with tuberculin the temperature reactions were: first case, before injection 101.4, highest 103.7; second case, before injection 102, highest 104.3.

Perhaps the most awe-inspiring of all the Empire's fresh-water fish is, according to the *Field* of July 7, 1917, the monster, which is caught in the inland waters of British Guiana, the giant arapaima. This is said to be the world's heaviest fresh water fish far exceeding in bulk even the silurus of Central Europe. But hitherto, there has been, as far as is known, no record of one over 200 lb. being caught on a rod.

The report on the Government Industrial School for Boys, Barbados, states that the area in sugar-cane at the Government Industrial School Plantation for 1917 crop is 27 acres. The crop of 1916 yielded 360 83 tons of canes from 42.59 acres, which is equal to 28.66 tons of cane per acre. There were 353.05 tons of cane sold to Carrington Plantation sugar factory at the average price of £1 7s. 5d. per ton of cane.

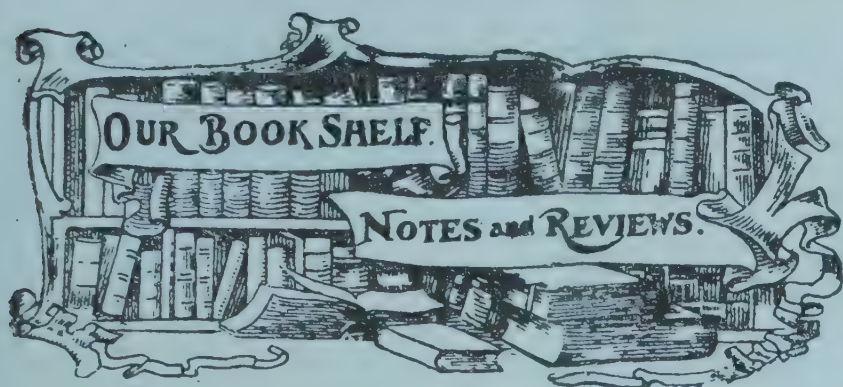
Up to July 31 last, there had been shipped from the colony of Trinidad 450,942 bags sugar and 63,184 400 lb. cacao, compared with 414,432 bags sugar and 46,386,800 lb. cacao, for the same period of the previous year. While coco-nuts fell from 10,406,655 from the previous year, to 8,640,930; this was made up by shipments in copra of an increase from 14,993 bags the previous year to 23,668 bags this year. (*Port-of-Spain Gazette*, August 4, 1917.)

The egg production of unselected White Leghorns averages about 130 for the first year, 120 for the second, less than 110 for the third, drops to 85 in the fourth year, and falls about 10 eggs a year after this up to the eighth year, according to *Bulletin 148 of the Utah Experiment Station*. Selected flocks have averaged 160 in America, and 190 in Australia. The average life of a White Leghorn hen appears to be about six years, and during her entire life her average production of eggs is above 500.

To protect fowls from ticks (*Argas Persicus*) the adults of which hide during the day and attack the birds at night, it is suggested that the perches should be scorched at least every three days with a torch of burning straw or wood-shavings. The use of perches, isolated by cups containing kerosene from the walls and floor of the houses, is recommended in the *Review of Applied Entomology* for June 1917, as well as frequent white-washing of the houses, which should be constructed with a minimum of wood; the laying boxes must also be so made as to allow of proper disinfection.

In Bulletin No 511 of the United States Department of Agriculture which deals with farm practice in the cultivation of cotton, it is stated that the results of these studies show that yields of cotton are governed largely by climatic conditions, the inherent fertility of the soil, the quantity of commercial fertilizers used, and the character of tillage given. The yields of cotton are directly related to the amount of tillage given after planting. The amount of tillage given is determined largely by the kind and number of weeds, the economic condition, and the prevailing weather.

The Poland-China breed of pigs is coarse, hardy, prolific, and much larger than the other ordinary breeds. This breed is the typical one in the Western States of America for the production of lard, and obtaining the best prices in the market. The western farmer is accustomed to graze his pigs in the summer, and the Poland-China is well adapted to this practice. It attains a very high weight, 880 to 1,100 lb. for boars, 550 to 850 lb. for sows, or sometimes even more. Its prolific character is indicated by the evidence of about 100 breeders, which shows that each litter contains on an average 9.75 young. Moreover the Poland China is one of the most long-lived breeds; the case is cited of a sow living for eleven years, during which time she had nineteen litters, and a total of 189 descendants. (*International Review of the Science and Practice of Agriculture*, October 1916.)



FIELD CROPS FOR THE COTTON BELT. By J. O. Morgan, M.S.A., Ph.D., Professor of Agronomy in the Agricultural and Mechanical College of Texas. *The Macmillan Company, New York.* Pp. 456, Figs. 75. Price 7s. 6d. nett.

As is explained in the Circular notice of the Rural Text-book Series to which the book to be reviewed belongs, the study of crop production for any large region involves a study of four general phases of the subject, as: 1. The plant, its structure, physiology and normal requirements; (2) a general survey of the region where it is proposed to cultivate the plant, to note how the natural conditions correspond to the needs of the plant; (3) the adaptation of the plant on the one hand to natural conditions, and the adaptation of soil on the other to the needs of the plant. Maximum production is obtained when perfect adaptation is secured; (4) protection necessary against other indigenous plants, fungus diseases, and insects. The treatment of subjects in the present text-book follows practically the above plan, and gives a good practical account of the characters, cultivation, and harvesting of the principal crops grown in the eleven Southern States known as the Cotton Belt. In many respects, climatic conditions in these states are widely different from those of any other large area of the United States, and, for this reason, practices involved in the production of field crops in this region present many modifications of those of other states.

The values of the eleven principal crops produced in the Cotton Belt will give some idea of the relative importance of each, and, expressed in millions of dollars, they are: cotton 699, corn (maize) 335, wheat 30, oats 28, sugar-cane 26, rice 16, ground nuts 14, Kafir and milo 6, sweet sorghum 5, rye 6 and barley 2. As might be expected, this text-book devotes most attention to the two leading crops, cotton and corn, more than half of its contents being devoted to the principles and practices followed in their production. As these crops are cultivated in the West Indies, the remarks dealing with them will be of interest and practical usefulness to readers in these islands.

As Sea Island cotton is restricted to the James and Edisto Islands and the adjacent mainlands along the coasts of South Carolina, Georgia, and Florida, this variety does not receive much attention in this book. It is mentioned, however, that recent studies by Watt indicate this cotton as being a modern development, for there is no evidence to show that it is indigenous to Barbados. Reference is also made to the fact that this species is so closely allied with *Gossypium vitifolium*, a long staple cotton of South America, as to suggest that its original habitat is somewhere in that continent.

Chapter VIII, dealing with fertilizers, manures, and rotations for cotton, dwells on the problem of maintaining the productive power of soils in the cotton belt, which involves such a system of cropping as will provide these soils with an abundance of organic matter and nitrogen, and the application of the two important plant-food

materials—phosphoric acid and potash—to the soils in which these constituents are more or less deficient. After discussing the value of cotton seed and cotton-seed meal as a source of nitrogen, and after giving fertilizer formulas adopted in the Cotton Belt for cotton, the book points out that although stable manure, especially when cotton is produced in rotation with other crops, is of unquestionable value, the cotton planter uses very little farm manure. The reason for this is that very little stock is kept other than working stock necessary to deal with the crop, and the most important source of organic matter in the Cotton Belt is that of green manures, either legumes or non-legumes. Of the first class, the cowpea, soy bean, bur and crimson clover, vetch, melilotus, and the velvet bean are the most important. Ordinarily, cowpeas will yield at least $1\frac{1}{2}$ tons of dry matter to the acre, in tops and roots, which is equivalent to an application of 6 tons of average pen manure containing 25 per cent. dry matter and 75 per cent. water, and will increase the nitrogen approximately 65 lb. to the acre. The different operations connected with tillage, harvesting, and marketing cotton are described in Chapter IX, while the two following chapters are concerned with the important enemies and diseases of cotton.

Although ranking second in importance in southern crops, maize is, if the United States be taken as a whole, by far the most valuable crop, for it is worth twice as much as the cotton crop. The chapters relating to this product are, especially at the present time, of peculiar importance to the West Indies. In the Corn Belt the principal use of maize is as food for live-stock, but in some of the smaller islands it is a staple article of diet. The paragraphs in respect to the effects and value of inbreedings, and the methods of producing cross-bred seeds should be of interest to planters, as should also be those which discuss the cultivation of the crop. The following rule for measuring shelled corn may be useful. Multiply the cubic capacity of a crib by 4 and divide by 10, and the result will be the number of bushels. In the United States the legal weight of a bushel of corn is 56 lb. of shelled corn or 70 lb. of ear corn.

To those concerned in the cultivation of rice, Chapter XXXI, which deals fully with the subject, affords practical information while the growing importance of the ground nut in the production of oil, and in replacing the cotton crops in districts ravaged by the boll weevil lends special value to the remarks on its culture. The fruit of the ground nut otherwise known as peanut, goober, or pin-dar, is really not a nut, but a ripened pod with edible seeds, the term 'nut' having been added on account of the flavour of the seeds resembling that of many true nuts. It is best produced in light coloured soils of a sandy or loamy nature, and is admirably adapted to combination cropping, the most important companion crop being corn which is often planted in alternate rows. Soils deficient in lime produce a large percentage of 'pops' or unfilled pods, and fresh manure applied immediately before planting has the same result. An important use of this crop in the Cotton Belt is as pasturage for pigs.

Although written primarily with the needs of the college student in view, this text-book will be of practical usefulness to West Indian planters and also to general readers, for considerable attention has been paid in it to the principles of plant structure and nutrition. As in the other books of this admirable and useful series, excellent illustrations accompany the text, and a valuable addition is a full and reliable index. The suggestion may be made that the price of the book should appear on the cover.

STUDIES IN CONNEXION WITH PELLAGRA.

In view of the growing interest being taken in investigations to discover the causes which produce pellagra, the results of some studies conducted in the United States and Italy, and reported in the *Experiment Station Record*, Vol. XXXVI, No. 8, p. 763, are of importance.

From the results of a series of observations in the United States of tissues obtained from dead pellagrins, and at autopsies of certain animals which had been given various diets with the view of producing, if possible, symptoms and tissue changes found in pellagra, the conclusion is drawn that the tissue alterations, including the degenerative changes in the nervous system occurring in animals as a result of malnutrition, are strikingly similar to those observed in pellagrous tissue. The pathological changes in tissues in malnutrition are very similar, whether resulting from (a) no food, (b) unbalanced diet, or (c) mild circulating toxins which interfere with nutrition of cells. In (a) congestion and fatty degeneration were more pronounced, while in (b) more pigment (hæmosiderin) was present.

In a second series of observations, which consisted of feeding animals upon a diet composed of boiled dried peas, cracker meal, and cotton-seed oil or lard, a diseased condition closely resembling human pellagra was produced. The ingestion of suitable quantities of meat caused these symptoms to disappear. The intake of a large quantity of peas, too, was found to be less detrimental than smaller amounts, while it was more difficult to produce these symptoms when a diet containing meat, cracker meal, and lard was given; and for the production of the diseased condition the meat had to be reduced to a certain undefined minimum. The conclusion is drawn that the abnormal condition is due to a deficiency of some essential dietary constituent or constituents.

SAND COLIC IN ANIMALS.

The results of the observations of a French veterinary surgeon as to cases of colic due to the ingestion of sand are summarized in the *Veterinary Record* of May 26, 1917. Sand colic is common in the Turks Islands, especially in droughts, among horses and mules which swallow sand in nibbling the short shoots and roots of grass in the parched pastures. It is easy to diagnose sand colic by the symptoms. The animal affected lies on its back, rolls, assumes abnormal positions, throws himself violently down, and rises again, paws the ground, makes more or less ineffectual attempts at micturition, and evacuates small balls of dry faeces mixed with sand in variable proportions.

Treatment for this sickness should be chiefly preventive. Special care should be taken to ensure that the drinking water should be as pure as possible, and to exclude all opportunities for the ingestion of sand by sheltering stables from winds, and by other measures.

Curative treatment is very simple. As soon as the disease appears the horse should be placed in a spacious stall where he cannot hurt himself, prevented from all inopportune movement and all agitation, and given a sedative draught containing tincture of opium. In most cases a rapid improvement supervenes, and in twelve hours the horse may be considered cured. The elimination of the sand is then commenced by means of small doses of pilocarpine; and a laxative régime is adopted which enables the horse to return to work after the lapse of forty-eight hours. Sometimes the symptoms indicate therapeutic measures, clysters, etc. Purgatives are always useless, and often prejudicial.

TRACTORS IN AGRICULTURE.

The Ministry of Munitions, which owns an extensive tract of fertile agricultural land in connexion with a munitions factory in the north of England, is encouraging its tenants to cultivate hundreds of additional acres by assisting in the ploughing of the land with tractors. Four American Mogul tractors of 16 horse power each, with Canadian 'Cockshut' three-furrow ploughs attached, have been at work in the vicinity for some months, and splendid results have been attained.

The tractors are manned by Army Service Corps M.T. Drivers. Each tractor has a speed of about 3 miles per hour, and the engines, which start on petrol, are worked by paraffin, the consumption of oil being about 2½ gallons per acre. The ploughs turn the land over to the depth of about 7 inches, and the furrows are even, clean, and straight. The average amount, ploughed in a full day under adverse conditions, has been 5 acres per tractor, but it has been ascertained that, under ideal conditions, each tractor can easily plough three-quarters of an acre in an hour. Besides being useful for ploughing, the tractors will be of great assistance during harvest, in hauling the binders, in threshing, and in taking the grain to the market. So much interest amongst the agricultural community has been aroused by the introduction of the tractors that, although at first the farmers were somewhat sceptical, they have become quite enamoured of the new invention. So complete indeed has been their conversion that, as related in the *Journal of the Board of Agriculture* of May 1917, they are in frequent communication with the agent in charge of the work with a view of buying the tractors after he is done with them. And, in France the value of tractors in agricultural operations is equally appreciated, as may be seen from the fact that a certain number of agriculturists in the arrondissement of Pontoise have formed themselves into an association in order to acquire tractors, and to undertake without delay ploughing and other farm works which have for the present been suspended. The capital has been subscribed by members in proportion to the area of arable land they hold, and this has allowed the purchase of thirty-two traction engines at a total cost of about £20,000. The tractors purchased include 18 Emersion 20 h.p. traction engines; 6 Arion 40 h.p.; 2 Avery 35 h.p.; 2 Avery 16 h.p.; 3 Avance 20 h.p.; and 1 Bull 16 h.p. The activity of the association will affect about 17,800 acres of arable land fitted for the intensive culture of grain and beetroot. The scarcity of agricultural labour in this district, as a result of the mobilization of Belgian workmen, the proximity of factories of war material, and the prohibition to employ prisoners of war which was long in force, decided the agriculturists to use these new methods of work as a matter of urgency. Counting the tractors already bought by individuals outside the association, there are now forty of these machines in the arrondissement of Pontoise, and the possibility of shortly using double that number ought to be realized.

AGRICULTURE IN BARBADOS.

The heavy weather for July spent itself on the 24th and 25th of the month. On these two days about 2½ inches fell. After this there was a week of fair weather which was beneficial to vegetation of all kinds, and also a relief to the planter who is most anxious to make timely progress with the work in hand at this season of the year.

Twelve inches is an exceptionally good rainfall for any month during the wet season. This figure was generally exceeded during last month, and it should be noted that the sea-board parishes were as favourably treated as the hilly districts.

Everywhere the cultivation of the fields to be planted in canes towards the close of the year is being pushed on as rapidly as circumstances will permit. The cane shoots have been practically cleared off, but, in many instances, labour was insufficient to remove all the trash that planters meant to stack up for manurial purposes later on in the season. Male labour has been generally sufficient, but the number of female workers has been inadequate. With a little encouragement the men have also turned out on Saturdays, and it surprises a passer-by to see how quickly a large field is blackened when a good gang of men is at work.

Some ploughing is being done but, owing to the fact that a good deal of trash has of necessity been left on the ground, forking after the cane holes have been opened is more the order of the day than last year. The tillage of some of the fields is most creditable, and in some cases, where whole fields of trash have been buried by the opening of deep cane holes, the mould gives the impression of having been sieved over the surface.

The Commissioners appointed under the Vegetable Produce Act, 1917, have issued a circular calling for a return from every landowner of the provisions planted by him to this date. At an earlier date a return was made stating what would be planted: this return is now to show how much of the contract has been fulfilled. We believe that, in the case of catch crops, the whole contract has been carried out.

An abundance of provision has been planted everywhere, and our correspondent in St. Lucy's parish states that what has been planted in that parish could not look better. This testimony can be applied to every parish, but in the red soil neither Indian corn nor the potato makes the same rapid progress as in the black.

The corn crop is by no means as mature as at this time last year. Some of this cereal is now sufficiently advanced to be used as food, but very little has yet reached the stage for harvesting. Potatoes will be abundant later on, and we hear that in St. James' parish this vegetable is already being retailed at 6 lb. for 10c. There will, however, hardly be any material change in price until about October. The yam crop also is much more backward than at this season last year. Very few fields have as yet developed the second spire. The crop is, however, healthy and it has not suffered as it did in some districts during July last year. As mentioned in a previous report, very few eddoes, comparatively speaking, are to be seen, nor has the preparation for this vegetable received very careful attention. (*Agricultural Reporter*, August 11, 1917.)

AGRICULTURAL COMMISSION IN BRITISH HONDURAS.

The Agricultural Commission, recently appointed in British Honduras with a view of ascertaining the causes of the present scarcity of foodstuffs produced in that Colony; and, if possible, to suggest means whereby the scarcity can be met by an increased production of home-grown provisions, have issued a series of seventy-three questions to planters and others, asking for information on different points in connexion with the object of the Commission. Among the questions are:—

44. In the island of St. Vincent there have been established by law associations on what is known as the Raiffeisen system. The plan of this system is for ten or more planters who want to borrow, to form themselves into a society, and on being registered they are able to borrow, from the

Government sums of money. The society as a whole, and each individual member pledges itself and himself to repay the amount borrowed at a given date. The Government deals only with the society, and the society with the individual member. Loans to members are either repayable by monthly instalments or at the end of a period not exceeding one year, the underlying principle being mutual co-operation and mutual liability, each member being liable for the debt of the other. Would such a scheme be workable in this Colony?

45. In the island of Jamaica there has been established a Land Loan Bank, which makes small loans to planters for periods of three, six, nine, and twelve months, on their personal notes backed by two responsible parties. It is understood that such loans are to be used solely for purposes connected with their holdings, and both borrower and backers are warned that if the note is not paid at maturity together with the interest at a low rate, it will be sued for. The experience of this bank has been that it has made no losses, and pays its shareholders 7 per cent. per annum. Do you think that the establishment of such a bank, either as an alternative to the Raiffeisen system or in addition thereto, would be successful?

STANDARDS FOR FOODS.

In the *Trinidad Royal Gazette*, Vol. 86, No. 26, is published an Order proclaimed on July 10, 1915, under section 3 of Ordinance No. 44 of 1916 to regulate the standards for certain articles of food, and these standards, which are worthy of the consideration of other West Indian islands, are:—

MILK. Any substance sold as milk shall contain not less than three per cent. of milk fat, and not less than eight and a half per cent. of solids not fat.

BUTTER. (a) Any substance sold as butter in tins not exceeding five pounds avoirdupois in weight shall contain not less than eighty per cent. of butter fat and shall be free from any admixture of other fat. (b) Any substance sold as butter in or from larger packages than five pounds avoirdupois shall contain not less than seventy-two per cent. of butter fat and not more than sixteen per cent. of water nor twelve per cent. of salt and shall be free from admixture of other fat. (c) Any substance consisting of butter but sold as cooking butter, cooking grease or under any other name than 'butter' shall contain not less than seventy-five per cent. of butter fat.

GHEE. Any substance sold as Ghee shall contain not less than ninety-eight per cent. of butter fat without any admixture of other fat.

MARGARINE. Any substance sold as margarine or as a substitute for butter shall contain not less than eighty per cent. of fats.

LARD AND LARD SUBSTITUTES. (a) Any substance sold as lard shall consist of the fat of the hog without any admixture of other fat or of extraneous matter, and shall contain not more than one per cent. of water. (b) Any substance sold under the name 'Lard Substitute,' 'Imitation Lard,' 'Compound Lard,' or under any other name as a substitute for lard shall contain not less than ninety-eight per cent. of fat.

VINEGAR AND WOOD VINEGAR. (a) Any substance sold as vinegar shall contain not less than four per cent. of acid produced by acetous fermentation and shall not contain any mineral acid or any acid obtained from the distillation of wood or from the oxidation of distilled spirit. (b) Any substance sold as 'wood vinegar' shall contain not less than four per cent. of acetic acid.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
July 12, 1917.

ARROWROOT—5d. to 7½d.
BALATA—Block, 3/- to 3/3¼; Sheet, 3/9.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, 66/- to 81/6; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 41d. to 45d.
FRUIT—Bananas, no quotations; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
ISINGLASS—No quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—Steady.
PIMENTO—3¾d.
RUBBER—Para, fine hard, 3/0¼; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., July 17, 1917.

CACAO—Caracas, 12½c. to 12¾c.; Grenada, 12c. to 12½c.; Trinidad, 11¾c. to 12½c.; Jamaica, 9¾c. to 10¼c.
COCO-NUTS—Jamaica and Trinidad selects, \$30.00 to \$32.00; culls, \$22.00 to \$23.00.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—17c. to 18½c. per lb.
GOAT SKINS—Jamaica, 75c. to 80c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 65c. to 70c. per lb.
GRAPE FRUIT—Jamaica, \$2.75 to \$3.50.
LIMES—\$6.50 to \$7.00.
MACE—28c. to 42c. per lb.
NUTMEGS—20c. to 21c.
ORANGES—\$1.75 to \$3.00.
PIMENTO—6c. per lb.
SUGAR—Centrifugals, 96°, 6.77c; Muscovados, 89°, 5.91c.; Molasses, 89°, 5.75c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., July 20, 1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.50 to \$13.00.
COCO-NUT OIL—\$1.10 per Imperial gallon.
COFFEE—Venezuelan, 12c.
COPRA—7c. to 7½c. per lb.
DHAI—No quotations.
ONIONS—\$7.00 per 100 lb.
PEAS, SPLIT—\$11.00 to \$12.00 per bag.
POTATOES—English, \$6.50 per 100 lb.
RICE—Yellow, \$8.50 to \$9.00; White, \$6.75 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., August 7, 1917.

ARROWROOT—\$9.00 per 100 lb.
CACAO—\$12.00 per 100 lb.
COCO-NUTS—\$26.40 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$8.00.
PEAS, SPLIT—\$12.00; Canada, no quotations.
POTATOES—\$6.25 to \$9.50.
RICE—Ballam, \$10.00 to \$10.50; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$5.00 to \$5.25.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND- BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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BARBADOS, SEPTEMBER 8, 1917.

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The Value of Scientific Research.

IN the last issue of this Journal the editorial dealt with the relations between science and modern industry, emphasizing the point that industry owes so much to science that it is essential that science should be not only encouraged but adequately provided for.

One supposes that hardly anyone, with any real knowledge of affairs in the West Indies, would nowadays dispute the fact that the brighter outlook

in these islands is very largely due to science applied to agricultural matters. The improvement in the manufacture of sugar, the chief industry in so many of them, may be instanced. Science has taught, after many experiments, that the way to extract the highest percentage of sugar from the canes is by using powerful crushing mills combined with maceration of the crushed canes. Again, it is to researches of science that the sugar manufacturer owes the knowledge that the best way to produce a fine quality of sugar is to boil it in vacuo; also, that in order to economise fuel recourse must be had to multiple effect evaporators. All these and many similar applications are the outcome of abstract scientific research subsequently adapted to practical ends.

To take another important industry of the West Indies; every cotton grower knows that in the earlier days of the industry it seemed at times as if it would have to be discontinued on account of the serious attacks of pests and diseases. By the assistance of science these enemies are being met, and methods of keeping pests in control, and of avoiding disease are being utilized, so as to put the cultivation of cotton on a secure basis.

Scientific research in plant breeding has also been of great value with regard to both these crops. With regard to canes, there is continual progress in the propagation of varieties with greater sugar content and more resistant to disease; with regard to Sea Island cotton, science is enabling the cultivator to maintain the quality of the crop without deterioration, and even to improve it.

But difficulty lies in the fact that the majority of mankind do not look, in this matter as in many others,

far enough ahead. Men are willing to acknowledge the benefits that bring them immediate profits, but for the most part they lack the power of imagination which would enable them to incur immediate expense and trouble in order to obtain insight into the fundamental laws of their business, although such insight would enable them, or future generations, to establish their business on a better and more lasting foundation.

This brings us to the question as to what is the value of scientific research, sometimes referred to as pure science, i.e. the seeking after knowledge for the sake of the knowledge itself. Many men say that this is of no use. They want to be taught *how* to do things, *how* to improve the processes of their agriculture or their manufacture, but they do not see the need or utility of striving to find out the *why* of things. This attitude of mind is not only unscientific, but unintelligent. It is true that in the ultimate sense the *why* of most things seems to be unobtainable, but the function of science is to be forever seeking for the *why*, because only in this way can secure foundations be laid for the carrying out in practice of *how* to improve. Scientific research is directed to the advancement of the knowledge of the laws of nature, i.e. *why* it is that things are as they are, and not otherwise.

A recent book, *Chemical Discovery and Invention in the Twentieth Century*,* gives the following instance of an important practical application which has arisen out of apparently recondite investigations, supplying a satisfactory answer to those persons who are often disposed to enquire as to the utility of this or that piece of pure scientific work which seeks to extend knowledge, without reference to the further use of it.

The researches of Professor Sabatier, of Toulouse, on combinations of hydrogen effected by the catalytic agency of finely divided metals, were begun in the closing years of the last century, and have led to unexpected applications for industrial purposes, which have assumed a position of great practical importance. Professor Sabatier has shown the chemist and manufacturer how hydrogen can be made to unite with a great diversity of materials by an easily carried-out process, and at no prohibitive cost.

Most vegetable oils, and some animal fats are liquid under ordinary temperatures, and consequently of less value than the fats which are solid under the same conditions. Professor Sabatier made known that it is only necessary to add finely divided porous nickel

to the oil, to heat it to a moderate temperature, and to inject hydrogen gas into the mixture, in order to harden the oil into a fat which is solid at common temperatures. The resulting hardened fats are of great commercial importance, being largely employed, especially in soap and candle making.

No sooner had Sabatier made known his method than numerous patents were taken out by other people, who thereby made great commercial profits, but Sabatier himself failed to share in the reward which might rightfully have been considered his due.

An instance like the above shows how applied science really depends upon pure science or research. Men who praise the practical achievements of applied science but speak lightly of work in fundamental research, are, it has been said, like men who congratulate themselves upon the electric lighting in their houses, and forget the power-house. Scientific research is the power-house that supplies the initial energy to applied science to which our modern civilization owes so much.

Workers however in scientific research, like Sabatier, receive scant rewards for their labours. For the most part they are unrecognized, though other men who, having been taught the *why* of nature's processes by the pioneers in research, turn that knowledge to practical advantage, reap the rewards and often the glory.

At the present time, more than ever, there is need of scientific research into numerous problems. During the war, and after the war, the *why* of many processes, industrial and agricultural, is being asked, and will be asked. The men who devote themselves to scientific research will devote themselves, as they have always done in the past, to the elucidation of these problems. They ought to be encouraged not only by the estimation in which they are held, but by adequate rewards, for the hope of reward sweetens labour. In Great Britain the recently appointed Department of Scientific and Industrial Research shows that the mind of the public and the Government is awakened to the value of co-ordinated scientific research. Such a body must be of extraordinary force in this matter. For scientific research, to have the fullest power, and to be of the greatest advantage to human welfare in solving problems and in laying firm foundations for practice, ought to be co-ordinated. Solitary workers have done much in the past, but the association of scientific workers obviates the waste of power which arises from want of knowledge of what other men are doing, thus enabling much more to be effected.

*'Chemical Discovery and Invention in the Twentieth Century', by Sir William A. Tilden, F.R.S., D.Sc., LL.D., Sc.D., Routledge & Co.

In this matter of progress it is sometimes forgotten that we cannot stand still, even if we would; the happenings in our surroundings carry us onwards, and, if we fail to respond, we are left behind to perish of neglect and inanition; this is true alike of individuals and communities. Progress is forced upon us; it is expedient therefore that we take pains to see that our progress is so directed as to bring us the greatest good.

SUGAR ESTATE ECONOMY.

In *The West India Committee Circular* of July 12, 1917, under the above heading, there appears a copy of a circular letter addressed by Colonel the Hon. R. Stapleton Cotton and Messrs. Henckell Du Buisson & Company to the managers of their estates in the West Indies. Between them the signatories of this letter have very large interests in the West Indies, the total output of sugar from their estates and the factories under their control in various islands being some 50,000 tons per annum.

This letter seems to inaugurate a far-reaching and straightforward policy on the part of owners and capitalists with regard to the employees in the sugar industry. We deem it so important as to reproduce a large portion of it in the present article, in fact, did space allow, the whole letter is worth reproducing.

The following are quotations from the letter referred to:—

It has always been, as you know, our desire to improve the circumstances of all on our estates when the revenues permitted. . . . It has also been a pleasure to us that the estate revenues have made it possible to give bonuses to the managers and overseers sufficient to render their circumstances comfortable for the present, and at the same time to enable them to invest something for the needs of later years.

In the case of these bonuses both to managers and overseers, and in the increase in labourers' wages, it has to be understood that they cannot be repeated or continued if the revenues fall back again. The revenues depend on two things, viz., the price of sugar and the crops produced. Sugar may continue above the average price for some time, but before very long it will in all probability drop back. . . .

In our opinion, the reasonable view to take of prices is that they will, after some little time, rule much about the average level of the last ten pre-war years, which was £11 per ton, f.o.b., for 96° Grey Crystals. Whenever the price has gone over that it has soon fallen below it again, and whenever it has gone below, it has soon recovered again.

Now £11 per ton does not, with the past average crops, admit of continuing the present higher pay. In England there is general agreement on the part both of employers and employees in the leading industries, that there shall be no return to the old low level of rates of pay, and further it is agreed by all on both sides that the only means of securing this is by increased production per man or woman. . . . And everyone is looking forward with hope, we might say with confidence, to the industrial production being increased, and to the higher wages being made permanent. The pressure of war production has revealed what can be done. . . .

Cannot a similar advance be made in sugar plantations in the West Indies? If not, we see no hope of a continuance of the present higher pay to the staff and the labourers. Increased production per man, whether manager, over-

seer or labourer, is the only means of securing this. It will be difficult, but we believe it can be accomplished if everyone does his utmost and gives his whole mind and energies to the work, not going on in the old routine, but looking out continually for a chance of introducing some improvement here or there. . . .

The establishment of a stock farm on a sound basis on each estate, with the manure resulting therefrom, and the introduction of rotation crops along with more liming and more tillage, will, we believe, lead to the improvement of the condition of the soil to such an extent that it will yield a very large increase in the cane crops. . . .

We are quite prepared to consider applications for expenditure required for additional live stock, alterations in stables and cattle sheds, silos, limekilns, and motor-driven implements for the lighter tillage, so that the additional tillage may not necessitate an increase in the numbers employed on the estates. Our aim is to keep the numbers who are at present employed, and to continue the present advanced pay; each one of them in his own sphere to do his utmost to increase the production of the land, so as to make this possible. . . .

It must be borne in mind that we are only prepared to develop stock farms if all the fodder is raised on the estate. Turning part of the cane tops into ensilage will help towards this, but the chief help will come either from raising better grasses on land that has now only abandoned pastures, or from raising fodder crops on fields that are thrown for their year's rotation out of cane.

THE AFTER-RIPENING OF SUGAR-CANE.

In the modern factory system which requires a constant supply of large quantities of sugar-cane, any deterioration of the sugar contents of the crop in its passage from the field to the mill may constitute a serious loss. In some districts in India it is a common practice to allow the canes to remain in heaps for a day or so before crushing, the reason given being that the gur obtained from such cane is drier and lighter in colour than if the cane is crushed immediately. Experiments, reported in the *Agricultural Journal of India*, Vol. XII, Part 2, have been made in India to see how long the cane may be kept without causing a loss, or, if storage of the cut cane is unavoidable, what are the extent of the losses likely to be incurred.

The length of time for which cane can be stored without suffering a loss of sugar, and during which an actual increase in the amount of sugar in the juice will take place, will, the journal states, vary with the temperature of the air and the condition of the cane. This period will become shorter as the temperature rises. Excessive cold, on the other hand, including too great a change in temperature, may also bring about losses in sucrose.

The Java system of covering cut cane with damp trash is to keep the cane stem alive. By this treatment the cane will be maintained at a uniform temperature and being in a moist atmosphere will not lose water. On the other hand, moist heat will not only induce the growth of moulds, fungi, and bacteria, all of which bring about decay by fermentation changes, but will, once the cell is dead, induce rapid decay in the cell contents by hydrolysis and oxidation.

The after-ripening of cane is a matter of some importance to the factory owner, and the chemical changes will probably be of interest to him as well as to the student of the chemistry of sugar.

Experience in the West Indies tends to show that in the conditions here prevailing, cut canes quickly deteriorate.

THE HORSE BEAN AS A GREEN DRESSING FOR CACAO.

Interesting notes on some experiments with the Horse Bean (*Canavalia ensiformis*) as to its value for growth under cacao trees in Grenada have been furnished by the Superintendent of Agriculture in that island. This bean has been used as a green dressing in lime and cacao orchards in several West Indian islands for many years, and also as a green dressing for arable land, as may be seen by reference to the Annual Reports of Experiment Stations; but its use for this purpose appears to have been neglected in Grenada.

That the attention of Grenada cacao planters has now been aroused to the possibilities of this bean as a suitable green mulch for their plantations is evidenced by the fact that between 5,000 and 6,000 lb. of cleaned seed has been distributed by the Agricultural Department during the eighteen months ended June 30, 1917.

The chief point in the experiments was to discover whether the *Canavalia*, possessing as it does the valuable properties of other leguminous plants, would thrive well enough under the shade of cacao to justify its cultivation for green-dressing purposes, so as to maintain or restore the fertility of land under cacao.

These experiments as far as they have gone, serve to support the idea that the *Canavalia* will furnish a desirable leguminous green dressing for cacao land.

The first of these experiments was conducted by the proprietor of Tuilleries estate. An acre of land under cacao, about 500 feet above sea-level, was sown with the beans in May 1916. The beans were planted two in each hole at a distance of 2 feet apart. The cacao trees on the plot are about twenty years old, carefully pruned, with foliage fairly thick. They stand from 10 to 14 feet apart.

In October the bean plants were about 2 feet high, flowering and bushing well, though, as was natural, there was a noticeable degree of attenuation in the growth, caused by the shade of the trees. Fourteen months after sowing the bean plants continue to thrive, and have produced a fair yield of seed.

The second experiment has been carried out by the managing attorney on Boulogne estate, on poor land. The cacao trees on the 3 acres experimented with are about fifteen years old, growing at an average distance of 10 feet apart. They are well pruned, but only moderately vigorous; hence the shade was less than in the first case. Three acres were sown broadcast with *Canavalia* beans, about half of the plot being sown in December 1916, and half in January this year.

In May this year the plants on the earlier-sown portion were about 18 inches high, and thick enough almost to hide the soil from view, and were beginning to flower. On the later-sown portion the plants were about 12 inches high. In June the plants in both portions were of fine growth, covering the soil completely.

On July 5 a trial cutting of the plants on the first-sown section was made. This indicated a yield of $4\frac{1}{2}$ tons of fresh cut material per acre. It was also estimated that the weight of stumps and roots left in the ground would be about $\frac{3}{4}$ -ton per acre—a total weight therefore of $5\frac{1}{4}$ tons per acre of vegetable matter.

It has yet to be determined whether the beans will ratoon well under the shade conditions of a cacao plantation.

A continuation of these experiments will yield valuable and reliable information as to the suitability of the *Canavalia* to be used as a green dressing, under conditions of very considerable shade.

AN EXPERIMENT IN STORING SEED-CORN IN GRENADA.

An instructive and successful experiment in storing locally grown seed-corn has been conducted in Grenada by the Superintendent of Agriculture, Mr. J. C. Moore, who has furnished this Office with a detailed report, of which the following is a résumé.

It must be remembered that corn kept for sowing purposes, and that stored for food purposes cannot be subjected to the same treatment. In the latter case the corn is dried at a considerable temperature, the process destroying to a certain extent its germinating power. In the former case the object is to preserve this power, at the same time eliminating as much moisture from the seed as possible without destroying its vitality.

In October 1916, the Superintendent of Agriculture in Grenada advised that an attempt be made to store locally grown corn to provide a supply of seed for general distribution in May and June 1917. Accordingly, in November, 60 barrels of corn selected from peasants' crops were stored in a room at the Botanic Station. This room is constructed mainly of wood, with a shingled roof, having a capacity of 3,120 cubic feet, and is well ventilated, the windows and ventilator openings being, however, screened with $\frac{1}{2}$ -inch mesh wire-netting.

The ears of corn, tied together in pairs by one or two of the segments of the husk, left on for the purpose, were hung across racks made of 6-inch boards placed edgewise in tiers spaced so as to insure free circulation of air throughout them, and to facilitate inspection; the total length of the racks being 426 feet. This afforded ample space, as it was calculated that 5 feet of rack could approximately hold the ears contained in a barrel, when the ears were hung three or four deep across them.

Windows and ventilators were kept fully open, except at night and during actual rainfall. A few weevils were noticed on the corn immediately after hanging, having probably obtained a lodgment there before the purchase of the corn. The only fumigation effected at this stage was by the fumes of a smouldering wood-fire for about six hours at a time on three occasions, at intervals of two weeks.

Shelling began on January 5, 1917. After being shelled, the corn was 'sunned' for two days, sifted in order to remove dust and chaff, fumigated with hydrogen cyanide for sixteen hours, and immediately stored in a bin. Owing to limited facilities this process took some time, being only completed on February 1.

The storage bin, $7\frac{1}{2}$ feet high and 4 feet square, was constructed of boards closely fitted, one half of the top being fitted with a movable cover. The inside of the bin was lined with roofing paper tacked on with overlapping edges, and the outside tarred to secure tight joints. The bin was provided with a flue suitably perforated, running from the bottom of one side half-way across the floor, then rising vertically through the centre of the bin to 18 inches from the top. The lower portion of the flue was made large enough to hold a gas generator, and fitted with a tight door. The cyanide fumes were thus enabled to penetrate thoroughly the stored corn.

As the corn was put into the bin, muslin bags, each containing 3 oz. of crude flake naphthalene were distributed at regular intervals throughout the mass. This did not seem to be efficacious in warding off insect attacks.

Fumigations of cyanide were applied on February 13 and 23, and on March 8. Two further fumigations of carbon bisulphide were applied on March 16 and on May 15. When emptied on May 23, a large number of weevils

were found at the bottom of the bin. Had the bin been thoroughly air-tight the effect of the fumigations would have been doubtless more complete. However, there was no indication of mildew observed.

As a result of this experiment over 4,000 lb. of seed-corn harvested in October last year has been distributed for planting purposes in May and June this year throughout Grenada and Carriacou. The seed was clean and bright in appearance, entirely free from mildew, practically free from weevils and moths, and possessed an indicated viability of 87 per cent.

One piece of useful information supplied by this successful experiment is that hydrocyanic acid gas can safely be used in fumigating thoroughly dry seed corn, without seriously affecting its vitality.

BREEDING OF CORN.

Field Crops for the Cotton Belt, the book reviewed in the last issue of this Journal, p. 629, contains in Chapter XVI some interesting observations on the breeding of corn with a view to fixing desirable characteristics.

Special stress is wisely laid on the possibility of greatly improving corn by breeding, and many proofs of this improvement have been furnished in the United States by experiment stations and other agricultural agencies. The initial step in the improvement of corn, the writer says, is the selection of the best varieties for the existing conditions, and it is a waste of time and money to breed varieties not well adapted to the soil and climate. When the variety is selected, the simplest method to improve still further the corn is by mass selection, which consists in selecting from a field a large number of ears from plants, which conform most closely with the ideal type. The next year this selected seed is mixed and planted, and this method is followed year after year. Mass selection has, as may be readily understood, the disadvantage of not being rapid in its results, and the quickest improvement can only be attained when the selection is based on a performance record of different individual ears. Pedigree selection differs from mass selection in that, after the first mother ears are selected, a record is kept of the performance of each ear and its progeny. It distinguishes between those plants that are good because of favourable environment and those that are good because of inherent productiveness. The inherent productiveness of an ear can be ascertained by no other means than by pedigree selection, or the separate culture and exact comparative trial of the generation grown from its kernels.

The readiness with which maize hybridizes, and the ease with which the plant is manipulated in artificial crossing have served greatly to stimulate the breeder's interest and effort in this method of corn improvement. The two most important objects in pursuing this method are, firstly, recombining the characters possessed by the parent plants so as to produce a progeny of increased value, and secondly, securing increased vigour and productiveness. The present conception of plants is that they are composed of separately heritable units known as 'unit characters', and the law governing their transmission was discovered in 1865 by George Mendel, being known as Mendel's law of hybrids. According to this law the dominant character shows in the first generation hybrid to the exclusion of the other. The recessive character reappears in the second and subsequent generations in one-fourth of the progeny, and thereafter remains pure. In corn, for instance, investigations have shown the following characters to be dominant over their opposites: yellow endosperms over white endosperms; starch

endosperms over sweet endosperms; flint quality of grain over dent; and dent quality over sweet.

Experiments on the lines suggested by the author, especially if records of such experiments were carefully kept, would doubtless prove of utility to growers of corn in the West Indies.

AGRICULTURAL CONDITIONS IN PORTO RICO.

Porto Rico for a very long time has been a country of small plantations, possibly similar to France, where the great wealth of the country has been developed by horticulturists and agriculturists in gardens and farms of small area. The *Louisiana Planter* of July 7, 1917, gives a short account of the colono or tenant system of farming, which was forced on Porto Rico more or less under the old feudal system of the ownership by one man or one interest of the sugar factory, of the slaves, machinery and outfit necessary to engage in the sugar industry, all involving such an absorption of the attention of the sugar planter to the estate developed in this way, as to leave practically no opportunity for small landowners to produce sugar-cane for sale, there being no market for it. The colono or tenant system has grown out of this, just as it has in Cuba. The instance is cited of one of the large sugar companies that has seventy-one colonos on the company's lands, or in some instances on their own lands. The average number of acres per colono was 4.43. In a general way where the sugar-cane is cultivated by the estate owners for their own account, the results are better in quantity and quality than when they come from the colonos. Under the present system, however, it is found very wise to utilize these colonos as far as practicable, and among them there has been quite a development, some of them cultivating from a thousand acres up to fourteen or fifteen hundred, receiving financial aid from the factory owners. It was found that in a list of twenty-one sugar factories 37 per cent. of the cane was grown by the factories' owners, and 63 per cent. by colonos, and that the cost per ton of cane to the estate for their own cane was \$3.92 per ton, and of the colonos \$3.89. These figures do not include the cost of weighing, hoisting, transportation, and such expenses as are essential in the central factory business, whether the canes are cultivated by the factory itself or by tenants.

Exhibition of Local Foodstuffs in St. Vincent.

—A patriotic demonstration and fête, organized by the Kingstown Board and the local West Indian Flag Day Committee, was held at the Court House on August 1. Among the most attractive exhibits was a collection of native food products for hard times at all seasons, which was arranged by the Agricultural Superintendent, Mr. W. N. Sands. The samples clearly showed that in many respects the Colony should be self-supporting. Loaves of excellent quality were exhibited consisting of 25 per cent. native kiln-dried corn meal mixed with 75 per cent. of wheat flour and wheat flour substitutes such as the meals of cassava, cotton seed, breadfruit, sweet potato, and pigeon peas, all of which could be locally produced. Other novelties were coco-nut butter, and lard oil refined from crude cotton-seed oil. Among the other foodstuffs exhibited were peas and beans of different kinds, arrowroot and cassava starches, sweet potato cakes, farine, corn, cassava, sugar, honey, yams, and eddoes. In connexion with the storage of foodstuffs a collection of live insects attacking corn and meals was shown, and the method of destroying the pests by means of carbon bisulphide explained.

COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland of Liverpool, write as follows, under date August, 7, 1917, with reference to the sales of West Indian Sea Island cotton:—

The business in West Indian Sea Island has been confined to Stained Cotton at 20*d*.

There has been a good demand for the better qualities, but unfortunately, there is no stock. Spinners are eagerly awaiting the new crop.

THE SEA ISLAND COTTON CROP OF 1916-17.

From Messrs. Henry W. Frost & Co.'s circular, dated August 4, 1917, we take the following statements of the Sea Island cotton crop of 1916-17 in the States of Carolina, Georgia and Florida. The Carolina crop is 3,573 bales against last year's 6,211 bales. The Georgia and Florida crop is 109,536 bales against last year's 79,067 bales. The amount exported to England and the Continent was only 1,469 bales, the balance of the crop being taken by American mills. The prices reached in March and April, when an embargo was put on Egyptian cotton, advanced from 55*c*. to 70*c*. On this basis nearly the whole remainder of the crop was disposed of. This was on the Savannah market. The Islands' market, opening in October, advanced from 50*c*. to 57*c*. and 65*c*. Every bag of this crop was sold. The extra fine planters' crop was shipped to England, but the balance of the crop was taken by American mills.

In Carolina there has been some increase in acreage for the forthcoming crop, and the reports are of distinctly favourable expectations. The conditions of the crop in Georgia and Florida, taken as a whole, are good. Unfortunately boll weevil is rendering planters apprehensive in some sections. Some damage has been done already, and there is fear of further damage to the crop later on.

AEROPLANE CLOTHS.

It has been officially said that the Government is supplying the seed to grow the flax needed for the wings of its aeroplanes. Cotton is not unserviceable for the purpose, but the preference for linen is marked, and does not arise solely out of a desire to utilize material grown in Great Britain. Cost can have very little to do with the matter, as the difference in price between one fabric and another is the merest trifle in the total cost of an aeroplane. The advantage possessed by linen is that of strength, traceable chiefly to the much greater length of the individual fibre. Weight for weight, linen is decidedly stronger than cotton, and it can be woven into cloth of a suitable lightness of, say, 4 oz. per square yard. Lightness is an important element in all accessories of aviation. Before being flown, the sails of an aeroplane are painted with a mixture known to airmen as dope. Cotton and linen both contract after doping, but it is reported that ramie does not. The trouble about ramie is, however, that it is brittle and weak at the joinings, although its strength across the wings is extraordinary. (*Journal of the Royal Society of Arts*, August 3, 1917.)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. The Agricultural Superintendent (Mr. W. N. Sands) reports work of a general routine nature in the Botanic Gardens during the month of July. Plant distribution included 400 cane cuttings and 23 lb. Bengal beans.

The weather during the month was wet, rain being recorded daily. Good progress, however, was made in the planting of crops. Cotton seedlings required a few days of sunshine; corn and peas looked promising in most districts.

Work was continued in connexion with the destruction of cotton stainers. From an attached report of the cotton Inspector thereon, it appeared that a considerable amount of work was performed by this officer during the month. No fewer than thirteen estates were visited, and arrangements made for trapping cotton stainers, and destroying silk-cotton trees. The cotton stainers were destroyed in some cases by means of cotton seed placed in heaps in the neighbourhood of fallen silk-cotton trees, and pouring boiling water on them when they were collected; in others by means of the kerosene torch, described in the previous number of the *Agricultural News* (Vol. XVI, No. 400, p. 267). The absence of stainers on some of the estates visited, which had previously been severely infested, bears testimony to the efficacy of the measures taken for the destruction of these pests, and to the importance of the work, which cannot be overestimated. Regarding other pests, the sugar-cane moth borer is reported as giving trouble on several estates.

The Assistant Agricultural Superintendent (Mr. S. C. Harland) returned from three months' leave on the 27th. The prohibition of the importation of seed-cotton and cotton seed into the Colony was gazetted. This precaution was taken against the possible advent of pink boll-worm. The rainfall at the Botanic Station for the month was 20.42 inches; at the Experiment Station 16.91 inches.

VIRGIN ISLANDS. Dry weather interfered with cultural work in the Experiment Stations during the month of July, writes the Curator, Mr. W. C. Fishlock. Varieties of beans were sown, sweet potatoes planted out, and the work of reconstructing the nursery commenced. The following plants and seeds were distributed: potato cuttings 300, coconut plants 6; banana slips 58; pine-apple slips 12; cotton seed 68 lb. vegetable seeds 12 packets. As regards staple crops, cotton appeared to be in fairly good condition. Much attention, says Mr. Fishlock, has been paid to the planting of food crops. No serious pests were reported.

The weather, as is noted above, was dry. Rain fell in measurable quantity on twelve days of the month, the total precipitation being 1.82 inches. The average rainfall for the month for the previous sixteen years was 4.31 inches. This is said to have been the driest July since weather records have been kept in Tortola.

Among the practical suggestions made by the advisory Committee appointed by the British Board of Agriculture to report on technical questions of poultry management and feeding, are, according to *The Field* of June 23, 1917, that all hatching should cease for 1917, that old stock cocks should be killed at once, that, with the exception of certain hens selected for breeding stock, all hens hatched in 1915 that go broody, or show signs of moult should be cleared, as well as any 1916 hens that indicate by their appearance that they will not be profitable, that as soon as possible all 1917 hatched cockerels not required for stock purposes in 1918 should be killed.



IMPROVEMENT IN THE MANUFACTURE OF LIME PRODUCTS.

The Report of the Agricultural Department, Dominica, 1916-17, a review of which appeared in a recent issue of the *Agricultural News*, No. 399, deals with several subjects of more than local value. Improvement in the manufacture of lime products, for instance, is doubtless a matter of interest in other islands, where the lime industry is being extended. The report of Mr. J. Jones, Superintendent of Agriculture in Dominica, dealing with this subject, is worth quoting. He says: 'During the year under review, citrate of lime was sold on the basis of about £27 per pipe. During the same period concentrated lime juice was quoted at £22 per pipe.'

'Whilst many planters received this latter price and found difficulty in disposing of their product, a number of others received £28 and over per pipe, and found a ready market.'

'The difference in price was due entirely to the difference in the quality of the juice manufactured. Those who took the slight additional trouble of preparing a clean sample of concentrated juice were rewarded to the extent of £6 per pipe and over. Now that the trade has differentiated between clean and dirty juices, and does not value the product on the acid content alone, a rapid improvement should soon be observable in the quality of the bulk of the juice leaving the island, and the shipment of thick dirty juice, should be a thing of the past.'

'There is an idea abroad that clean juice cannot be prepared by the open-fire process. This of course is a fallacy, as some of the best juice leaving the island to-day is manufactured by the open-fire method. The writer has seen juice prepared by steam concentration having a sediment test of close on 100 units. The essential condition in the preparation of clean concentrated juice is that the raw juice should be as free as possible from pulp. To attain this end several different methods are practised. First the raw juice as it comes from the mill is kept for several days in vats to settle and only the clear juice drawn out for concentration; or the whole is passed through the still, and after boiling is run into settling vats and allowed to remain there for twelve to twenty-four hours. It is well known that boiled juice settles quicker and more thoroughly than raw juice. In some cases planters use both the above methods, that is they settle the raw juice as much as is convenient, withdrawing the clear juice directly into the concentrating vessel, and distilling only the cloudy juice. No doubt the cleaner juice is obtained by heating the bulk to boiling for some time, and then settling the juice, finally withdrawing the clear juice.'

'The chief difficulty in preparing clean juice is the treatment of the sediment. It contains a very considerable amount of acid which must be recovered. Filter-presses—familiar objects in sugar factories—are not used in lime juice factories. Two processes are adopted to obtain the last of the acid out of the sludge. The latter is placed in bags made of cloth and allowed to drain, or still better, placed in a specially made filter-bag consisting of two bags, one, the larger placed within a second, the smaller, the smaller of the two having no bottom. The other method is to allow the sediment to run into a separate vat, stirring it up with a quantity of water, allowing it to settle, and drawing off the clear liquid. The second process appears

the more practicable when large volumes of juice are being dealt with. In this second process it becomes a matter of some importance to determine the number of times it is economically sound to continue the washing.

'With this end in view experiments have been conducted in this laboratory, and it would appear that if time is an important factor, the best way to treat the sludge is to add water to the extent of 2 parts to 1 of sludge. In a few hours—six to ten—the pulp settles, and the clear liquid may be drawn off and concentrated. It is not economically sound at the present value of citric acid to further treat the residue.

'If however the element of time is not pressing, then the most efficient way of dealing with the sludge is to add equal parts of water, allow it to settle eighteen to twenty-four hours, draw off the clear liquid, and again add water in equal parts. From data supplied to this Department as to the cost of concentrating a gallon of juice, which is given at 1 cent per gallon, it would appear that at the present value of citric acid, the washing described may be repeated three times, but that a fourth washing is not profitable.

'By the first method 66·6 per cent. of the acid is recovered from the sludge, and by the second process, provided the washing is repeated twice, 75 per cent. If, however, the washing is repeated three times, then 87·5 per cent. of the acid will be recovered.'

Mr. Jones refers also to the successful employment of steam for concentrating lime juice, which is now being generally used.

AGRICULTURAL CREDIT SOCIETIES IN ST. LUCIA.

An Agricultural Credit Societies Ordinance was passed in St. Lucia in 1915, coming into force on January 1, 1916. The first annual report, submitted by Mr. M. A. Beaubrun, Government Inspector of Agricultural Credit Societies, is included in the Report on the Agricultural Department, St. Lucia, 1916-17. During the period reported on, six societies were registered, with a total number of 151 members. The first year's working has proved an unqualified success, witnessed by the fact that arrangements have been made with the Colonial Bank to make advances to these societies under the St. Lucia Agricultural Credit Societies Ordinance up to £3,000 at the rate of 7 per cent. per annum. The Inspector records his sense of the gratitude that is due to the office-bearers of each society, as well as to the clergymen in the districts where the societies have been established, for their valuable assistance in every case without pecuniary reward.

It is not sufficient, however, the Inspector thinks, that the societies should exist only for the purpose of granting loans to members. Each society should arrange to handle and ship the produce of its members, so that they may receive full market value, and not be at the mercy of local speculators. Such co-operation creates confidence amongst the members.

It can safely be said that the coming into operation of this Ordinance has sounded the death-knell of the usurer, whose method was to extort interest from the peasant at the rate of 2s. in the £ per month. The Agricultural Credit Societies Ordinance, worked along the present lines, will eventually lead to the financial emancipation of the small planter, and conduce to the general agricultural development of the island; and for this reason it deserves support of all who have the welfare of the island at heart.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial deals with the value of scientific research work as the basis of practical improvement in agriculture and manufacture.

On page 279 a short article draws attention to the success attending the first year's working of the St. Lucia Agricultural Credit Societies.

A review of a lately published book on Farming by Motor will be found on page 285.

Insect Notes, on page 282, deal with some insect pests in Jamaica. On page 286, under Plant Diseases, attention is drawn to a new cane disease appearing in Porto Rico.

Progress of Science in Japan.

In 1916, an Act was passed in the Imperial Diet of Japan, to grant subsidies to the amount of 2,000,000 yens (yen = 2s. 0½d.) spread over a period of ten years to the establishment of a scientific laboratory in Tokio, and the Imperial Household has also decided to donate 1,000,000 yens to the undertaking. The laboratory will be completed in ten years time, and it is intended, as is stated in *The Board of Trade Journal*, Vol. XCVII, p. 669, that researches in connexion with electrical and electro-chemical industries, chemical and other products, industries, and processes will be carried on. At the request of the public or individual clients special research on particular questions will be made.

Honey in War Time.

In an article on bees in relation to agriculture which appeared in the issue of this Journal of July 14, 1917, it was stated that, besides being a fascinating study, apiculture might be of considerable profit to those engaged in the industry. Recent market advices, as is announced in *Gleanings in Bee Culture* of June 1917, show that honey has already reached a high level in price. When war was declared in August 1914, the price of honey in the United States sank to a very low figure—3 or 4 cents a pound; and now some of the same honey is being delivered in New York at 12 cents. While it is true that the general rise in the price of all food products, including sugar, has inflated the price of extracted honey, there are other factors to be considered.

Recent inquiries in New York show that there is an unusual demand for extracted honey for export. From reliable information it is clear that immense quantities are being used in Europe to preserve cakes and bread, for it is a well-known fact that honey will keep baked articles soft and moist as almost nothing else will.

Another important factor is the scarcity of sugar and of syrups in Europe, and American honey is employed to fill, in a measure, this deficiency in supply.

Honey, too, is taking the place of glycerine in pharmaceutical prescriptions. Glycerine which was formerly used largely by apothecaries has become prohibitive in price on account of the European governments commandeering it for the manufacture of explosives. Honey in many prescriptions is of great value, for it blends, as readily as glycerine, with alcohol; and a new dressing which is placed with remarkable results over scalds, burns, and general wounds is almost two-thirds honey.

The Iodine Content of Foods.

Among the several mineral elements in foods in minute quantities, especial interest attaches to iodine on account of its important function in animal metabolism. As far as is now known, the function of the thyroid gland is metabolism of iodine.

At certain periods of life when the activities, of the organism are increased, and consequently

when an increased metabolism of iodine is required, the thyroid may enlarge as a result of its increased activity. This enlargement of the thyroid appears most commonly at the period of adolescence. The administration of iodine during that period, however, may prevent thyroid enlargement, or if the thyroid is already enlarged, it diminishes its size or may reduce it to normal. In view of this fact and of the fact that goitre is prevalent in some regions of the United States, while in others it is rare, researches have been made to know whether there is a difference between the iodine content of foods in areas where goitre is prevalent as compared with areas where goitre is rarely seen. The results of these investigations, reported in *Bulletin 299* of the Ohio Agricultural Experiment Station, emphasize the variety and accidental nature of iodine as a food constituent, and indicate the necessity for a study of factors other than the diet which affect the amount and condition of the iodine present in the thyroid, as promising results of greater significance in relation to the cause of goitre.

Annual Reports of the Society of Chemical Industry.

The Society of Chemical Industry has done wisely in following the example of the Chemical Society in initiating the compilation and issue of annual reports on the progress of the various sections of applied chemistry dealt with in its journal. It is a bold venture to carry out such an undertaking in circumstances so unpropitious, and *Nature* of June 14, 1917, welcomes with sincere pleasure the advent of an enterprise which is bound to have a far-reaching influence on the development of chemical industry in all English-speaking countries. Its inception at the present time is most opportune. Thanks to the energy, skill, and perspicacity with which it is conducted, the journal of the Society has become its most valuable asset. It is certain that these annual reports are destined to be a no less valuable feature of its work, provided that those who control its affairs are determined to rise to the full extent of their opportunity.

Insecticidal Plants from the Tropics.

In an article contributed by Professor Maxwell-Lefroy to *Tropical Life* for June, it is remarked that in most parts of the tropics one finds plants which are known to the natives, and which they use for killing fleas and vermin, or for keeping off flies and mosquitoes; rarely, as in India, one finds a plant reputed to kill insects in water or to prevent white ants. Such plants are worth investigation. Can they be obtained in any quantity? Do they remain efficacious if dried? What part of the plant is used? Is it available only at one season or always? Such are the questions to be asked, and it is necessary to know exactly how the plants are used locally, and for what purposes. All plants which have such properties, which are available in a dry form in quantity at not too excessive a price, are worth sending for trial at the present time.

Careers in Tropical Agriculture.

The work of the British Empire Producers' Organization has, as is pointed out in a recent issue of *Empire Trade Notes*, revealed the existence of a great development of technical application to tropical agriculture, and steps are being taken in association with other institutions, to prepare a case for the establishment of a chair in this subject at the University of Glasgow and at one English centre, probably London or Cambridge. Ours is the largest of tropical Empires, and within its confines exist boundless resources in such commodities as sugar, cotton, copra, rubber, etc., which afford opportunities for immense industrial developments. The study of scientific culture in regard to such departments has been in the past carried on much more thoroughly and systematically in foreign countries, and it has been necessary to employ expert ability in highly paid positions. It is now felt that the careers that are open to specially trained young men in these fields should be secured for the benefit of our own people. The proper method of instruction must necessarily include some knowledge of chemistry and engineering, botany and entomology, in view of the likelihood that more and more use will be made of mechanical and biological methods in the future. It is important that expert managers of tropical estates should have full knowledge of any progress in the design of suitable machinery for efficient production, so that a course of study would include instruction in that direction, and it would be necessary that a portion of the time should be spent in the tropical regions to attain proficiency. It is probable that such a career will be peculiarly attractive to many of the young men of the coming generation.

Loss of Fertilizers by Leaching.

Cultivated soils are subject to loss of fertility from two main causes, the plant food contained in the crop removed and that leached out of the soil by rain. The amount of plant food removed by different crops is well known; but the amount lost through leaching, and also what elements of plant food are so lost are not so definitely known. *Bulletin 132*, for November 1916, of the University of Florida Agricultural Experiment Station, contains a report of experiments undertaken to obtain definite information on these points under Florida conditions. As a result of five years' work the following conclusions, amongst others, are stated:—

Newly cleared land when exposed to heavy rainfall soon loses much of its fertility through leaching.

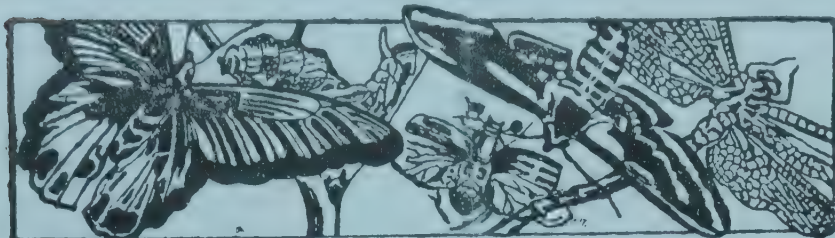
The fertility of the soil may be maintained by growing leguminous crops, and applying fertilizers.

The greatest loss of fertility from unmanured soils occurs with nitrogen, which leaches through in considerable quantities.

Lime is lost in considerable quantity, tending to bring about an acid condition in the soil.

Distribution of rainfall influences to a considerable extent the amounts of the fertilizing constituents which leach through.

These conclusions, it must be remembered, apply only to Florida conditions, and to soils similar in character to that used in the experiments.



INSECT NOTES.

SOME INSECT PESTS IN JAMAICA.

The Annual Report of the Government Entomologist of Jamaica, Mr. A. H. Ritchie, has recently been received. This deals with the more important insects occurring in Jamaica during the year ended March 31, 1917, and forms part of the Annual Report of the Jamaica Department of Agriculture for the above period. For the most part, only those insects which are likely to be of interest to readers in these islands will be referred to under their host plants in the following notes.

SUGAR-CANE. The West Indian sugar-cane leafhopper (*Stenocranus saccharivorus* [Delphax saccharivora]) has been the most important pest of this crop during the past year. A parasitic fungus (*Fusarium* sp.) was instrumental in checking this leafhopper to a considerable extent during the rainy season of 1916. This disease is apparently not fatal to the insect until the adult stage is reached, as the young stages are never found dead from the attack, whereas the adult hoppers are killed by the fungus, and usually remain attached to the cane leaves. During the dry months from December to March this fungus ceased to be of any value except where the standing canes were thick enough to maintain the humidity necessary for its development. Consequently the leafhoppers were practically unchecked, and the young plant canes soon became infested with young hoppers, followed by the 'sooty-mould' fungus or 'black blight', which is not parasitic. An attack of this description on the young canes reduces the number of canes per stool, and with unfavourable weather, leads to the ultimate failure of the plants.

Three other natural enemies of this leafhopper are recorded: (1) a species of Chrysopa, or 'lace-wing', (2) a predaceous bug (*Zelus rubidus*), and (3) the larvae of a Syrphid fly. Various ants were observed carrying off the young hoppers, especially when any of these were blown off the plants by high winds. The ants, however, were also seen carrying off the beneficial Syrphid larvae, and the predaceous bug *Zelus* seems to show a similar lack of discrimination between beneficial and injurious insects. Of all the above natural enemies the parasitic fungus seems to be the most efficient when weather conditions are moist enough to favour its development. The introduction into Jamaica of more natural enemies of the sugar-cane leafhopper is being considered.

This same species of leafhopper or 'cane fly' is occasionally a pest in other West Indian islands, but it is usually controlled by natural enemies, chiefly a species of Chrysopa. The red ladybird beetle (*Cycloneda sanguinea*) has also been observed on cane plants infested with the hoppers.

COCO-NUTS. The glossy star scale (*Vinsonia stellifera*) occurred on one estate in such unusual numbers on young bearing coco-nuts as to be injurious. This scale is found on many plants in the West Indies, but it is rarely abundant.

Strategus titanus is the common coco-nut beetle in Jamaica, but is not a serious pest, only occasionally injuring the cabbage, especially of younger palms. The beetles are

usually dug out by hand, or a strong carbolic solution is poured into the burrow.

As a remedy for palm stems attacked by the pin-hole borer (*Xyleborus* sp.), an emulsion of carbolineum is recommended. Such trees, if left untreated, succumb to the attack in from eighteen months to two years.

The brown weevil (*Metamasius sericeus*) is only found on diseased or wounded coco-nut trees, and is not regarded as a primary pest. It also breeds in felled banana stems unless these are cut up and spread out to dry. This beetle, it may be remembered, is the same as the sugar-cane weevil borer in other islands, and was formerly called *Sphenophorus sericeus*. It is generally considered to be a secondary pest, and is usually found only attacking cane that has been previously injured by the moth borer, etc., or that is diseased in any way.

CITRUS. The spiny white fly (*Aleurocanthus woglumi*) since its discovery in Jamaica in 1913 has been spreading throughout the citrus-growing districts, and is now considered to be the most serious pest on this crop. When once this white fly has gained entry into a grove it has been observed to spread very rapidly, and its effect on the trees very soon becomes evident. In connexion with the control of this pest, experiments are being made with a variety of ant (*Cremastogaster brevispinosa*, Mayr., sub-sp. *tumulifera*, Forel, var. *tumulicula*, Forel). Mr. Ritchie states that a citrus grove on one estate had ceased to bear as a result of the excessive injury of the fly, and growth was completely arrested. With the establishment of the ant, the trees are perfectly clean and have returned to bearing. Trees minus a nest or where a nest has failed may readily be recognized—intensely black, foliage shrivelled and dry, new growth absent, crop nil. The exact behaviour of this ant towards the scale insects and aphids occurring on citrus has not been determined, but other members of the ant group are known to protect and even to colonize scale insects and aphids, both of which are often injurious to many plants. It may be of interest to note that a closely related sub-species of the above ant is generally distributed in Barbados, and is often found on plants attacked by scale insects, mealy-bugs, or aphids. Both this ant and another related species in Grenada have been found by Ballou to damage trees directly by getting into pruning cuts or wounds in the bark and preventing the cuts and wounds from healing over. These ants are known locally as acrobat ants from their habit of walking along with the abdomen, or hinder part of the body, turned up. The Barbados acrobat is *Cremastogaster brevispinosa*, Mayr., sub-sp. *minutior*, Forel.

The natural insect enemies of *Aleurocanthus* in Jamaica include the ladybird beetle (*Lioscymnus diversipes*) and a species of Chrysopa. An attempt will be made to introduce another ladybird beetle (*Delphastus catalinae*) from California. Parasitic fungi also occur on the spiny white fly, but are unable to control it. An oil emulsion spray is being used against this pest with great success. Owing to the scarcity and high prices of the potash whale-oil soaps, it has been found necessary to use hard soaps instead. The following formula, mixed in the usual way, has given good results: Hard soap, 2 lb.; diamond paraffin oil, 2 gallons; soft water, 1 gallon. For the spray use 1 part of this solution to 60 gallons of water.

Mr. Ritchie has found *Aleurocanthus woglumi* on two new host plants, both introduced into Jamaica from the East some years ago. These are the Mahwa tree (*Bassia latifolia*) and the Wampie (*Clausenia wampie*).

Among other citrus insects is a new species of green weevil which injures citrus leaves. This has been described

by Dr. G. A. K. Marshall of the Imperial Bureau of Entomology as *Pachnaeus citri*.

PIMENTO. A new species of armoured scale (*Odonaspis pimentae*, Newstd.) attacks the trunks and larger branches of the pimento trees in some localities. This tree normally sheds its bark in long strips at intervals, but the scale insect interferes with this normal process of bark-shedding by gradually producing a bark-bound condition, and at the same time gradually weakens the tree by sucking the sap. No parasitic insects have so far been recorded from this scale, but it is attacked by the black fungus (*Myriangium duriaei*), and the red-headed fungus (*Sphaerostilbe coccophila*).

Termites are responsible for injury to pimento trees which have been damaged by storm or by careless breaking of twigs by pickers of the crop. Remedies advised are the control of careless breaking, and use of white arsenic in the nests. A small quantity of this poison put down in the galleries is carried into the nest by the insects and well distributed. The damage done by termites in general, and some of the control methods used against them have been mentioned in the *Agricultural News* for August 26, 1916 (Vol. XV, No. 374).

PINE-APPLE. This crop was found to be attacked by the grubs of a new weevil, which was determined by Dr. Marshall as *Metamasius ritchiei*. A technical description of this weevil has appeared in the *Bulletin of Entomological Research*, Vol. VII, Part 2, October 1916. The grub either bores into the stem causing the pine-apple to break over prematurely, or else it tunnels in the fruit inducing fruit rots, which attract the brown weevil (*Metamasius sericeus*). Suggestions for control included the digging out and splitting open of infested plants so as to expose the grubs to weather, and to natural enemies, such as fowls, hogs, lizards, frogs, etc. The plants so treated will dry out and the further development of the immature stages of the grub will be prevented. This pest has so far occurred only in one district, but a high percentage of the crop has been lost, and it is very difficult to get healthy slips.

The pine-apple scale (*Diaspis bromeliae*) and mealy-bug (*Pseudococcus bromeliae*) are generally present on pine-apples. The planting of clean slips helps to control the mealy-bug and its attendant ants. An oil emulsion spray is effective against the scales and mealy-bugs, while the addition of carbolic acid serves as a repellent to the ants.

These notes will be continued in the next issue of this Journal.

J.C.H.

Destruction in St. Vincent of Host Plants of the Cotton Stainer.—A report of this work has been handed in by Mr. Sands, the Superintendent of Agriculture in St. Vincent, to His Honour the Administrator. From this report, a copy of which has been forwarded to the Commissioner of Agriculture, it appears that a total number of 11,570 'John Bull' trees (*Thespesia populnea*) and 1,552 Silk-cotton trees (*Eriodendron anfractuosum*) have been eradicated in St. Vincent during the period from August 1916 to June 30, 1917. In addition, thousands of seedlings of both species have also been destroyed.

Mr. Sands pays a well deserved tribute to the efficient and tactful manner in which the Cotton Inspectors have performed their work, which has often been of considerable difficulty. Sometimes it was not found possible to fell a silk-cotton tree growing amidst cacao cultivation, for fear of the damage to the plants beneath it. In such cases the trees were 'ring-barked' with the hope that they would die before developing pods. An instance is mentioned of a ring-barked

tree which nevertheless fruited, and became 'literally covered' with cotton stainers in all stages of development, attracted from the neighbouring cotton fields. It was necessary to take immediate action. A man was set to climb the tree, and cut back the limbs so as to throw all the pods to the ground. This was done so carefully that only five cacao trees were somewhat damaged. To prevent the myriads of insects spreading over the district they were trapped with cotton seed and destroyed by means of boiling water and the gasoline torch, as described in the previous issue of the *Agricultural News*, p. 257.

Mr. Sands states that there is a general firm conviction that the silk-cotton tree is a serious menace to the cotton industry of the Colony, and that there is need to destroy this favourite food-plant of the cotton stainer pest.

The British Rubber Industry.—According to Professor Dunstan, Director of the Imperial Institute, whose article 'Some Present Needs of the British Rubber Industry', appears in the issue of the *Bulletin of the Imperial Institute* of December 1916, the British Empire has gained the premier position in the world as producer of raw rubber. In 1915 the total export of British plantation rubber exceeded 70,000 tons, whilst the natural forests of Para trees in the Amazon district of Brazil exported only 34,629 tons. In that year the United States took more than half of the British-grown rubber in addition to 20,000 tons imported from Brazil, while some of the great rubber-manufacturing enterprises in the United States have begun to acquire land in the tropics for rubber production. Apart from the effect of the war upon the various industries in the United States, which no doubt accounts in a large measure for the increased exports, America has become the principal rubber-manufacturing country in the world. The problem of the United States is to acquire control over the production of the raw material that she utilizes, while that of the British Empire is to apply to manufacturing purposes the raw material over which it now has control. In his report on Para rubber cultivation, published in June 1914, Mr. Bancroft showed that the area in British Guiana was 4,018 acres and was still increasing. As however only 4,000 lb. of rubber has been exported from that Colony during the present year, it can hardly be said that the industry has advanced beyond the experimental stage. The importance of the development of the industry is one which may well receive attention of the Government and people of British Guiana.

The *Port-of-Spain Gazette*, August 17, 1917, states that at a meeting of the Agricultural Board of Trinidad, Mr. F. C. Ulrich, Entomologist of the Department of Agriculture, reported that in order to obtain evidence one way or another as to the fowl-eating propensities of the mongoose, he had obtained the contents of some mongoose stomachs. On one estate the stomachs of 149 mongooses, caught between December 27, 1916 and February 10, 1917, were examined with the following results: small birds' feathers in 8, parts of toads and frogs in 33, of lizards in 9, of crabs in 10, of fish in 34, of insects in 63, of snakes in 4, of mice and rats in 11, and of egg-shell in 1, while the stomachs of 28 were empty. In another district the stomachs of those caught during the dry season contained no animal matter at all. It would appear, therefore, that in Trinidad at least, the much reviled mongoose is not quite as black as he is painted by many of his enemies in the smaller islands.



GLEANINGS.

In a recent number of the *Agricultural News* it was noticed that the issue of the *Kew Bulletin* would probably be discontinued. From *Nature*, July 12, 1917, we learn, however, that the Treasury has informed the British Science Guild that the issue of the *Kew Bulletin* is to be continued, subject to the omission of certain classes of information, the publication of which can be postponed.

All the wells of Bathurst, Gambia, have been stocked with fish to protect them from larvae, and the fish have proved their value, few wells being found to contain any larvae. In the lagoons also the fish have been very successful, and there has been a complete absence of the clouds of *Culex* that used to invade the town from time to time. (*The Colonial Journal*, July 1917.)

A correspondent in the *Port-of-Spain Gazette*, August 11, 1917, writes as to the advisability of planting castor oil as a crop, on the grounds that it demands no great cultural care, and that good crops are assured under tropical conditions, while the market can be relied upon on account of an increasing demand for the oil as a lubricant, especially for motor engines and aeroplanes.

There has been much examination in Egypt and India of the various schemes for helping agriculturists by means of banks, and the general conclusion is that such banks should be of the co-operative kind. It is essential that the members of the society should be responsible to one another. When this is the case it becomes a nucleus of self-government, order, education, and economy. (*The Colonial Journal*, July 1917.)

As a result of the investigation in the digestibility of vegetable fats, C. F. Langworthy and A. D. Holmes report in *Bulletin 505*, United States Department of Agriculture, that it is reasonable to conclude that olive, cotton seed, peanut, coco-nut and sesame oils are very completely and readily available to the body, and that they may, like the animal fats, be satisfactorily used for food purposes. (*Experiment Station Record*, Vol. XXXVI, No. 9.)

Studies in the feeding and breeding of ostriches for the purpose of increasing the production of high quality feathers have been made on a ranch at Glendale, Arizona. Among the young chicks raised are several from a cross between the Nubian and South African birds. It is believed that by such a cross an improvement in the quality of the feathers may be accomplished. (*Report of the Bureau of Animal Industry*, United States Department of Agriculture, September 15, 1916.)

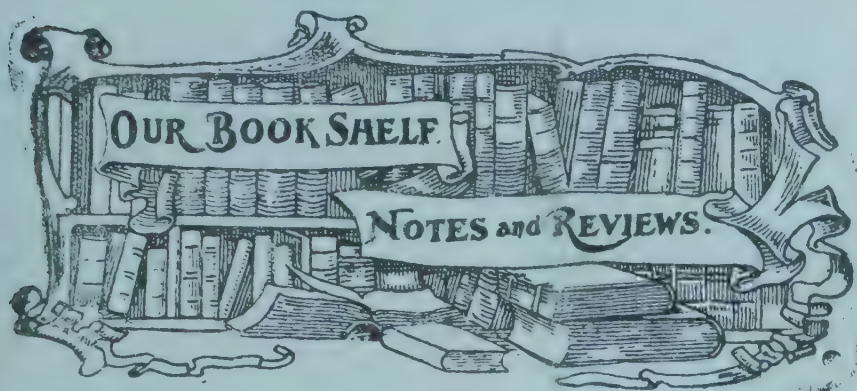
British Guiana and British Honduras have extensive forests, covering probably five-sixths of their area, as yet largely untouched. There is thus a splendid opportunity afforded to the Governments for carrying out a forestry system under which, through regulated natural reproduction, or systematic replanting, and through research as to the economic uses to which the native woods can be put, these forests would be a permanent source of wealth to the people and of revenue to the Government. (*Financier and Bullionist*, May 12, 1917.)

The Gazette, Turks and Caicos Islands, July 28, 1917, contains a report of a sub-committee of the Turks and Caicos Islands Agricultural and Industrial Society, proposing that an exhibition of the products and industries of the Dependency be held in January 1918. The Committee append a list of prizes recommended in various classes. Besides the usual classes of products displayed in such exhibitions in the West Indies, we notice the following exceptional ones: sharks' skins prepared for shipment; trolling or towing baits—spoons or spinners—of local make; corned, salted, or smoked fish in lots of about 5 lb.

From the Report of the Chief of the Bureau of Animal Industry, United States Department of Agriculture, dated September 15, 1916, we learn that the foot-and-mouth disease discovered in October 1914 has been completely eradicated in the United States. For more than a year and a half constant warfare has been waged against this highly infectious malady, which at times threatened to break beyond control, and ravage the stock-raising and dairy industries of the United States, as it has those of other parts of the world. The work of eradication was carried out by co-operation between the United States Department of Agriculture and the authorities of the affected States.

In some of the West Indian islands anthrax in animals has caused, or is causing, anxiety. *Farmer's Bulletin*, 784, United States Department of Agriculture, contains a description of the history, symptoms, and treatment of this disease. As to preventive measures, the following advice is given: 'to eradicate anthrax from infected districts preventive inoculation will play a very important part, but, in addition, infected areas should be thoroughly drained, and kept under cultivation for some time before attempting to pasture stock upon them. The complete destruction of all anthrax carcasses is also very important. This is best accomplished by burning, but deep burial may be practised instead. All discharges from the body openings should also be burned, or buried deeply.'

In an experiment of relative feeding value of certain common sources of high protein-carrying feeds from both animal and vegetable sources, it has been observed, according to the New Jersey Stations Report of 1915, that the poultry receiving protein from an animal source, meat scrap, produced in the two years of the experiment a total of 8,501 eggs, as compared with 4,710 produced by those receiving soy bean meal, 4,003 by those receiving gluten feed, 2,847 by those receiving linseed meal, and 2,995 by those receiving cotton-seed meal. From the stand-points of egg production, general health of the fowls, and economy, the protein from the animal source was the most efficient. The flocks receiving cotton-seed meal and linseed meal apparently broke down during the second year. (*Experiment Station Record*, Vol. XXXVI, No. 9.)



FARMING BY MOTOR: ALL ABOUT FARM TRACTORS AND MOTOR PLOUGHING. Temple Press, Ltd., 7-15 Roseberry Avenue, London, E.C. Price 1s. 6d.

The question of substituting mechanical motors for mules and cattle for hauling ploughs and other farm implements is attracting wide attention; the appearance of this little work is, therefore, extremely opportune.

After discussing the general aspect of the case as regards the need for economical motors in farming practice, the book deals with the capabilities of the farm motor tractor, subsequent chapters dealing with types of farm motors, the question whether motor tractors or motor ploughs are most desirable, and the quantity of work done by motor power. These questions are largely discussed from the point of view of the present needs of British farming.

What will perhaps prove of greatest interest to West Indian readers is that section of the book which makes reference to types of farm motors, and gives brief specifications of typical machines. As is stated in the introduction to this section, the machines selected are solely illustrations of types, not necessarily the best obtainable. When the type most suitable for local conditions has been selected, particulars of that type can be obtained from the manufacturers or agents. Twenty-two types of machines are thus illustrated and described; they are for the most part motors of moderate power, ranging from about 18-30 b.h.p., though in one instance a 70 b.h.p. motor is described.

This book is calculated to be of material service to West Indian readers in view of the great interest that attaches to mechanical means of hauling ploughs, cultivators, and weed machines. It contains much that is suggestive and instructive.

In connexion with the foregoing, reference may be made to a more powerful type of tractor than the majority described in the book above-mentioned; this is the Caterpillar Tractor made in two sizes, namely, 45 and 75 b.h.p., by the Holt Manufacturing Co. of Peoria, Illinois. This tractor, like the Bullock Creeper and the Martin tractors described in the book 'Farming by Motor', travels upon a creeper or endless track, instead of upon wheels; this ensures a wide distribution of weight, whereby the machines are enabled to travel over irregular or soft ground.

VOCATIONAL EDUCATION IN THE UNITED STATES.

On February 23, 1917, President Wilson signed the Federal Aid Vocational Education Act, the passing of which marks an important step taken by the Federal Government in its relation to education. Under the new measure, federal appropriations ultimately aggregating over \$7,000,000 per

annum have been made available for co-operation with the several States in the promotion of vocational education in agriculture, the trades and industries, and home economics including the preparation of teachers.

The most radical innovation in the Act deals, as is described in the *Experiment Station Record*, Vol. XXXVI, No. 8, p. 701, with the method of administration, at the head of which is provided a Federal board for vocational education. In addition to the administration of the Act, it is empowered to make, or have made, investigations and reports to aid the States in the establishment of vocational schools and classes, and in giving instruction in agriculture and other industries. These investigations are to include agriculture and agricultural processes, and the requirements of agricultural workers, and similar inquiries into the principles and problems connected with other industries, and with courses of study and instruction in vocational subjects.

To co-operate with the Federal board in carrying out the Act, each State when accepting its provisions is to designate a State board of at least three members, while, in the discretion of the central board, the studies concerning agriculture may be made in co-operation with or through the Department of Agriculture.

The State board has to prepare plans for the approval of the Federal board, showing the details of the work for which it is expected to use the appropriations.

The plans of expenditures for salaries in agricultural subjects must, in addition, show that the controlling purpose of the education is to fit students for useful employment, that the training is less than college grade, and that it is designed to meet the needs of persons over fourteen years of age who have entered upon, or who are preparing to enter upon, the work of the farm or of the farm home. The State, or local community, must provide the necessary plant and equipment, including a school farm or other farm for use at least during six months per year of supervised practice in agriculture, as well as contribute one-half the expenditure for the salaries of the agricultural teachers and supervisors. Except that no provision is made for the federal payment of the salaries of supervisors or directors, the requirements in other industries are similar to those laid down for agriculture.

The training of teachers and supervisors is restricted to persons who have had adequate vocational experience in the line of work for which they are preparing themselves, or are acquiring such qualifications as a part of their training.

Although a Federal board, closely linked with the Bureau of Education, has been created, each State is left free to establish a separate system, or to make the vocational schools and courses a part of its existing schools; the great advantage being that, probably, different plans will be adopted in the different States, and that thus there will be many experimental efforts to solve the problems of vocational education.

The training of teachers, to be provided for under the Act, will throw a heavy burden of responsibility on the higher technical institutions, and particularly on the agricultural colleges, which have not, up to the present, paid much attention to the training of teachers for secondary schools of the strictly vocational type. There is, therefore, great incentive for men of original thought and inventive skill to enter this comparatively new field.

Progress under the provisions of the new Act seems likely to be awaited with unusual interest throughout the world. Especially as at this time attention is being focussed as never before, upon all that pertains to agricultural and industrial efficiency as an element of national preparedness.

PLANT DISEASES.

A SERIOUS NEW CANE DISEASE IN PORTO RICO.

The *Louisiana Planter* dated August 4 published an account by Mr. John L. Stevenson, Pathologist of the Insular Experiment Station, of a cane disease which has appeared in the north-western quarter of Porto Rico, and has been observed for at least three seasons to be spreading steadily.

It occurs at present in a district some 40 to 50 miles across, mostly in fields among the foot-hills and in the river valleys. Many fields have already had to be abandoned so far as cane growing is concerned. The coastal plain is practically free as yet.

SYMPTOMS.

'The one marked and constant symptom of the disease, and the one by which it is easily recognized by anyone who has occasion to visit diseased fields, is the peculiar mottling of the leaves.' This feature is described as differing distinctly from the familiar chlorosis, (known variously in the West Indies as moonshine, saltpetre, or gall patches). 'In the case of the disease under discussion the leaves are marked with numerous white or yellow spots and stripes with irregular, indefinite margins. These are generally much longer than broad, and while in initial cases they may be few in number, they are generally so numerous as to occupy in the aggregate a large portion of the leaf surface. In newly attacked stools the leaf surface forming the back-ground may be dark green, but as a general rule it becomes a light abnormal green or yellowish-green, so that a sick field is noticeable from a distance because of its light colouring.'

Affected stools may be dwarfed, but others are to all appearances normal except for the mottling described, and this may occur on one, several, or all the stalks of a stool. Plants from the apparently healthy canes of a partially affected stool all give rise to mottled shoots.

In the advanced stages of the disease, in ratoons which have become very much stunted, a constant character is the appearance of discoloured areas on the stalks. These are grey or dirty white in colour, and may be so abundant as almost to cover the surface of the internodes. They become slightly sunken, but do not penetrate deeply into the tissues.

EFFECTS.

The losses in advanced cases of infestation extend to the complete failure of the crop; in others to reduced yields in all degrees, according to the proportion of stunted stools and rotted stalks. The affected canes have a tendency to be pithy, and poor in juice, and the behaviour of the juice is liable to cause a great deal of trouble in the factory. As a consequence, the various centrals refuse to receive cane which shows evidence of the disease.

CAUSATION.

None of the many fungi encountered during the study of the disease has been found to be capable of initiating it in experiments, nor has the juice of diseased canes proved infectious when injected into healthy canes. Its cause is up to the present completely unknown, but it is believed not to be due to any parasite. A comparison is suggested with the Serch disease of the East Indies, which it resembles in many respects, but with which it does not correspond in detail.

TRANSMISSION.

It has been found that cuttings from affected canes invariably reproduce the disease, no matter how they are treated or in what soil they are planted. The disease, once it has appeared, is cumulative in the successive crops of ratoons. It is not stated that the soil retains the infection, but it appears from the spread of the disease, and from the information that some of the seedling and foreign varieties brought in for trial from other districts have been attacked, that there is some means of transmission other than descent from affected stools or affected strains.

SUSCEPTIBILITY OF VARIETIES.

From the first, the Otaheite (Bourbon) cane has been especially susceptible, and the elimination of at least that strain of it which is grown in the infected district seems certain. Other native white varieties are attacked. A striped cane which last year appeared to be somewhat resistant has in many sections proved as weak as the Bourbon. A dark-red cane of which much had been hoped has also shown evidence of succumbing. As mentioned above, seedling and foreign canes have been introduced from other districts. In some instances they have been readily attacked, in others the outcome is still doubtful.

CONTROL.

The measures which have proved successful in dealing with other cane diseases: 'increased fertilization, liming, very thorough preparation of the soil, most careful selection of disease-free seed, treatment with Bordeaux mixture, use of new land, introduction of new varieties or of seed of new strains of old varieties brought from outside districts; all these and other methods as well have been tried, either singly or in combination, without uniform results other than that the disease has continued to gain ground.'

In the main, concludes the writer, it will be advisable for a few seasons at least to substitute some other crop for sugar-cane on the fields in which the disease has become prevalent. A rotation of crops which would include a legume, food crops, and then cane is suggested as the ideal system for the infected region. Reference is also made to the possibility of establishing the larger fodder grasses and reviving the industry of cattle-raising.

Some remarks on the analogies between this and certain other much-discussed diseases will appear in a subsequent issue of this Journal

W.N.

AGRICULTURE IN BARBADOS.

July and August 1917, have been just the reverse of these months for the year 1916. In July 1916 there was a shortage of rain, and August of that year was a very heavy month during which over 12 inches was registered. This year the rainfall for July was considerable, while during August there have been spells of showerless days.

The past fortnight has been one of activity in connexion with the putting out of farmyard manure. Everywhere carts may have been seen laden with this valuable article. In some instances it is being applied direct to the fields, in others it has been put on the pens now in process of formation, to be distributed at a later date. On several sides we have heard planters speak of the backward condition of their manure supply, as compared with that of some previous years. We regret to hear this, as a good supply of manure, and especially of farm-yard manure, is indispensable to agricultural prosperity. At this period last year there was similar

complaint, and the lack of material for building up full heaps of compost was dwelt upon.

With the scarcity of potash and ammonia, farm-yard manure becomes increasingly important, but apart from this, it is distinctly advantageous to create out of the estate itself the means of renewing the fertility of the soil. We have no doubt as to the choice of planters between rich farm-yard manure in sufficient quantity and artificial fertilizers. With one voice they would bear testimony to the more enduring effect of farm manure. The best efforts should be put forth to raise the largest amount of this manure, and the resources of an estate in this direction should be developed to the highest degree.

In general the young cane crop continues to develop satisfactorily. In the black soil, particularly, the bunches of plant canes are full and luxuriant, and we have also observed some very satisfactory fields of first ratoons. In the red soil, the ratoons are doing well, and, in general, fair progress is being made by the plant canes. The plant canes in some fields still, however, show a certain amount of hardness, the result of the severe weather during the planting season of last year and the earlier months of this year. In the red soil, cane holes are necessarily very deep, and we think that it would be a good plan if priming with manure could be done. It has been proved that this is productive of very satisfactory results.

The crisis in connexion with the extreme shortage of ground provisions is beginning to pass. We do not mean that there will be immediate abundance, but both potatoes and corn are gradually becoming more plentiful. Potatoes, which not long ago were sold at 8s. per 100 lb., can now be purchased at 6s. Indian corn flour is being hawked at 5c. per pint, and trays of green corn are not an unfamiliar sight. Greens are also increasing fairly rapidly in quantity, and the breadfruit trees are doing their 'bit' to relieve the tension of the food supply. It is a pity that these most valuable trees are not systematically cared for both by tillage and by an occasional manuring, where they are not favourably situated. (*Agricultural Reporter*, August 25, 1917.)

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice market for the month of July 1917:—

The condition of the drug and spice markets throughout the month of July has shown but little or no change since our last report for June, either in bulk of business transacted or in prices obtained. Purchasers generally do not go beyond that which is sufficient to meet their immediate wants. The following are some of the principal details.

GINGER.

At the first auction on the 4th of the month, ginger was in fairly good supply, 375 bags of Jamaica being offered, a few only finding purchasers at 95s. per cwt. for good ordinary small, and 85s. for common dark small. As many as 720 bags of rough washed Cochin were also offered, and bought in at 72s., and rough brown at 70s. Again on the 18th of the month ginger was in good supply but in poor demand, being represented by 588 bags of Cochin and Calicut and 268 bags of Japanese; a few only of the latter

found buyers at 40s. for fair, but slightly wormy, and 30s. for very wormy.

SARSAPARILLA.

Sarsaparilla was in small supply, and in little demand in the early part of the month, but it was reported that some small sales of red native Jamaica and Mexican had been effected at 1s. 11d. and 1s. 5d., respectively. A week later some small arrivals of Lima-Jamaica and Honduras were quoted at 3s. 3d. per lb. for the former and 2s. 4d. for the latter. Again on the 25th of the month, the offerings at auction were small, consisting only of 2 bales of native Jamaica and 30 bales of Mexican. The former were both sold at 2s. 3d. per lb. for dull yellow; 5 bales only of the Mexican were sold privately, the remainder being held at 1s. 5d.

CITRIC ACID, LIME OIL, PIMENTO, ANNATTO SEED, CASHEW NUTS, CASSIA FISTULA, KOLA, AND TAMARINDS.

Citric acid has remained at a firm and even price of from 3s. 3½d. to 3s. 4d. throughout the month. Oil of lime has been firm at 8s. 6d. per lb. for West Indian distilled, and 16s. for hand-pressed. Pimento has been but little in demand at 3½d. per lb. Annatto seed was in large supply at auction on the 26th of the month, when 79 packages were offered but none sold. At the same auction cashew nuts and Cassia Fistula pods were represented by 12 packages of the former and 34 packages of the latter, none of which found buyers. Kola, however, at the same sale, was in fair demand, 125 packages being sold out of 165 offered, good sound slightly dark Java fetching 6¼d. per lb., and part wormy 5d.; good sound African quarters fetched 9d., and small slightly wormy 8¼d. For 3 bags from St. Lucia fair, part whole 6d. to 6¼d. per lb. was paid. At the end of the month 25 barrels of new crop Barbados tamarinds were offered, and sold at 35s. per cwt. in bond.

Regulation of the Sale of Fertilizers in South Africa.—The *Union Gazette Extraordinary*, of March 19, 1917, contains the copy of a Bill to regulate the sale of fertilizers, farm foods, seeds, and pest remedies in the Union. The provisions of the Bill, as summarized by *The Board of Trade Journal* of May 24, 1917, are as follows:—

No person shall sell in the Union as a fertilizer any article which does not contain in a form or combination available as plant food, nitrogen, or phosphoric oxide, or potash, or lime.

The Governor-General is empowered to make regulations with respect to the marking, labelling, or branding of sacks, parcels, etc., containing fertilizers, farm foods, and pest remedies, and for the registration of such articles.

From and after the commencement of the Act, all fertilizers imported as merchandise at any port in the Union may be detained for purposes of analysis or examination by officers appointed in that behalf, and any such article found, upon analysis or examination, to be otherwise than required by the Act, or not marked or labelled as required, may be disposed of as the Department of Agriculture may direct. It is also provided that no person shall sell seeds unless there is attached to the package a written label giving the name of the seeds and their country of origin. The label is to imply a guarantee to the seller that the seeds are not below the standard of purity and germinating capacity prescribed by regulation.

Every person who sells any fertilizer or food shall provide, at the time of purchase, an invoice stating the quantity sold, the name and brand under which they are registered, and also their chemical constituents which have been registered as required by regulation.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
July 26, 1917.

ARROWROOT—5d. to 7½d.
BALATA—Block, 2/9- to 3/4½; Sheet, 3/10½ to 3/11.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 41d. to 45d. per lb.
FRUIT—Bananas, no quotations; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
ISINGLASS—No quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—1/3 per lb.
NUTMEGS—10½d.
PIMENTO—3¾d. per lb.
RUBBER—Para, fine hard, 3/2½; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., August 8, 1917.

CACAO—Caracas, 12c. to 12½c.; Grenada, 11¾c. to 12c.; Trinidad, 11¾c. to 12½c.; Jamaica, 9½c. to 9¾c.
COCO-NUTS—Jamaica and Trinidad selects, \$32.00 to \$33.00; culls, \$22.00 to \$23.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 75c. to 80c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 65c. to 70c. per lb.
GRAPE FRUIT—Jamaica, \$2.75 to \$3.50 per box.
LIMES—\$6.50 to \$7.00 per bbl.
MACE—38c. to 42c. per lb.
NUTMEGS—20c. to 21c.
ORANGES—\$1.75 to \$3.00.
PIMENTO—5¾c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 7.52c; Muscovados, 89°, 6.66c.; Molasses, 89°, 6.50c, all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., August 24, 1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.50 to \$13.00.
COCO-NUT OIL—\$1.25 per Imperial gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—No quotations.
DHAL—No quotations.
ONIONS—\$7.00 per 100 lb.
PEAS, SPLIT—\$11.00 to \$12.00 per bag.
POTATOES—English, \$5.00 per 100 lb.
RICE—Yellow, \$10.00 to \$10.75; White, \$7.00 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., September 4, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$12.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$8.25 to \$9.00.
RICE—Ballam, \$10.00 to \$10.50 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$5.75 to \$6.00.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND- BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split		
Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'badon		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles Cordwood		



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Local Cultivation of Food Crops.

ONE of the lessons which the present war has brought prominently to public notice, is the necessity for each country to be able, as far as possible, to feed itself from its own resources. The danger of being dependent to any large extent for the necessities of life on products imported from foreign countries has been acute in Great Britain, and the same danger menaces the population of the West Indies, which of late years has come to rely more and more upon imports of food chiefly from Canada and the United States. We cannot say that in these islands we have been in actual danger of famine, but the menace has been such that the Governments of the

various colonies, and the Agricultural Departments and Agricultural Societies have bent their efforts towards rousing the attention of the people to the necessity, as a sound economic precaution, of increased production of food crops which can be grown locally in sufficient quantities to feed the population. In another article in this issue there is given a résumé of the results of these efforts in various islands. It is evident that success on the lines of self-support is possible to a very large extent, if energy enough is displayed, and if people will understand that it is really sound policy.

The almost complete dependence for foodstuffs, such as flour, meal, beans and peas, butter, salt fish and salt meat, which has been exhibited in the West Indies during recent times, was not the case in the earlier history of the colonization of these islands. The early colonists proved able to feed themselves soon after their settlement. Ligon, who published his History of Barbados in 1657, describes very fully the resources of the island as to foodstuffs. Wheat flour was apparently the only article of that class imported, and that was so scarce that it seems to have been used only in cake and pastry making. In place of wheat flour the colonists used meals made from cassava and maize, and Ligon praises bread made of a mixture of the two*. These,

*Ligon's actual words are:—

‘Having said as much of the bread of *Cassavie* as I know, I give you one word of another kind of bread they make, which is a mixt sort of bread and is made of the flower of *Mayes* and *Cassavie* mixt together; for the *Maies* itself will make no bread, it is so extream heavy and lumpish: But these two being mixt, they make it into large Cakes, two inches thick; and that, in my opinion, tastes the likest to English bread of any.’

A true and exact History of the Island of Barbadoes, by Richard Ligon, Gent. (p. 30.).

together with sweet potatoes, they cultivated in large quantities. Later on various beans and peas were introduced, and these also were very generally grown on all the estates.

There are reasons why the planters have in most of the islands given up growing provision crops to any great extent. First, there was the abolition of slavery, a natural corollary of which was that the planters were no longer legally responsible for providing food for the labourers on their estates. It was generally considered that the labourer could look after himself, and out of his wages buy his own food, especially as the expansion of agriculture in the United States was making it possible to import largely and cheaply such articles of food as flour and meal. In the next place the then high price of sugar and its by-products rendered the cultivation of sugar-cane so remunerative, that, wherever possible, all the energies of the planter were devoted to it. After emancipation also, the labour supply was deficient throughout the West Indies, so that the planters believed that it was more to their advantage to cease cultivating food crops, and to employ all the land and labour they could in the production of sugar.

This was, one can now see, a shortsighted and mistaken policy in several ways. The shortage of labour was really accentuated by it, for in so many of the islands there was abundance of uncleared or forest land, where the emancipated labourer could make a clearing, and, with his few wants, support himself and his family on its produce without even working for a wage. Thus the production of locally cultivated foodstuffs gradually fell into the hands of the labourers, who did not grow much more than was required for their own maintenance, while the planter was forced often to restrict his cane cultivation, because he could get no labour. In another way the increased dependence on imported foods was a mistake, because the profits which certainly did accrue from selling foodstuffs were diverted from the pockets of those who might have produced them locally into the pockets of the importers, a large portion ultimately of course being remitted to farmers of other countries who grew enough for export. Again it would have been of more advantage, probably, to the planter to have grown a rotation of such crops as corn, beans, sweet potatoes, or cassava, with his sugar-cane, than to have gone on planting crop after crop of cane on the same land, even if he had to cultivate fewer acres. It was also a shortsighted policy because of the dangers incident to any agricultural community of depending upon one crop only. Thus when the

price of sugar went down, the cultivation of sugar-cane was still the only resource in most of the West Indian islands, and yet money had to go away to obtain the food which the country did not supply, but which might have been produced had the cane grower correctly realized the economic situation.

Almost the only island of the West Indies where the planters have continued to grow, along with sugar-canes, considerable crops of foodstuffs, is Barbados; but even here the general complaint of late years has been that there is a great decline in this matter. Here we are faced with another cause of the disinclination of not only the large cultivator, but even the man who cultivates but an acre or two, to plant such crops as corn and potatoes. This is the prevalence of praedial larceny, of the immorality of which the West Indian labourer seems to have such a small idea. The Governments in the various islands are being awakened to the necessity of putting this down with a strong hand, if continued progress in the matter of food production is to be assured.

It has been suggested in the publications of this Department that praedial larceny would be checked, at least in some degree, if crops were protected by hedges. If hedges were planted along the main roads they would screen the young crops, and render them less tempting to the thief, and less accessible. Landowners would do well to give this matter consideration.

The question of increased food production is a pressing one to-day in almost every country of the world. It is being met in England by a very large increase in the acreage put under food crops. In the West Indies it will have to be met in a similar way. Owing to the shortage of ships, and the expanding rates of freight consequent thereon, the price of imported articles of food has gone up immensely in these islands since the war began. The price of sugar has risen even higher in proportion, but it will not be wise, therefore, for the sugar planter to continue in, or return to, his neglect of food products. It would probably make for the advantage of the planter both pecuniarily and with regard to his being able to secure a supply of contented labour, to pay attention to raising food crops in order that the labourers may obtain cheap and wholesome food.

The chief interest of these islands is agriculture, and the more crops are diversified in an agricultural country the more secure is the basis of its prosperity. This has been exemplified in the recent history of the

West Indies. The cultivation of spices, limes, cacao, fruit, and, not least, cotton, in different islands, has certainly helped to increase the prosperity of them as a whole, and to give a hopeful outlook for their future advancement. If, in addition to crops such as are mentioned above, the owners and occupiers of land, great and small, co-operate in extending largely the cultivation of food crops suitable to their localities, it cannot be doubted but that the whole condition of these islands, agricultural and commercial, will be bettered, and placed on a securer basis.

THE NEGLECTED POMEGRANATE.

Of all fruits at present grown, merely as a fruit pleasant to the taste, the pomegranate is probably the one of which we have the earliest records in history. It is mentioned with honour in the earliest writings extant of the nations who are the parents of modern civilization. Homer mentions it in the *Odyssey* as grown in the gardens of Phœnicia, and the references to it in the Bible, from the Mosaic books onward, are frequent, as will be easily remembered.

The pomegranate is probably a native of the western parts of Persia. Thence it was dispersed eastward and westward to China on the east, and along the borders of the Mediterranean to the west, very early in historic times. Wherever it was introduced it was held in high esteem as a fruit. The conquerors of the Western Hemisphere, among other fruits, such as the orange and its relatives, did not fail to introduce the pomegranate, so long cultivated in Southern Spain. Since then the cultivation of the pomegranate has spread through all the tropical and semi-tropical regions of the New World. And yet to-day it is one of the most neglected fruits in these parts of the world; the reason being probably want of care in cultivation, and no attention to selection, which has caused a deterioration of the fruit.

In the United States, however, there has been of late more interest in this neglected fruit. There are still descendants of the old pomegranate trees planted by the first Spanish settlers in California. These are still of a fair quality, but distinctly of a mongrel seedling type. As a possible fruit for export to northern markets the pomegranate has been the subject of experiments at the College of Agriculture Experiment Station, Berkeley, California. From *Bulletin No. 276*, January 1, 1917, the following particulars as to variety and culture are taken.

There are two general types of pomegranate grown in California at present, the white-flowered type and the pink or red-flowered type. The white-flowered type is considered undesirable for cultivation as wanting in attractiveness, flavour, and keeping quality. As to the red-flowered type, the different varieties vary in every direction, but among them there seem to have been evolved varieties of great merit. There are only five which at present are found to be of value in the fruit market. Of these the one which is most in favour in California, and which has taken a place in northern markets, is the one which is designated Wonderful. Apparently this is a sport from Florida cuttings brought to California in 1896. Both from description and from illustration it must be an attractive fruit.

As was said above, the pomegranate is a very neglected fruit in these islands, because, like the Californian variety before selection was brought to bear on it, the

pomegranate in the West Indies is only a mongrel seedling. The importation of fine varieties, the selection of promising native varieties, and a little attention paid to its cultivation might bring to public favour in these islands this most ancient fruit.

The climate suits the pomegranate, for although it is grown in the East in almost desert regions, being well adapted to withstand drought, yet it will grow and fruit well under conditions of heavy rainfall, thus making it adaptable to dry islands such as Antigua, or to wet ones such as Dominica. The pomegranate, therefore, in its improved varieties may be well worth experimenting with by our West Indian horticulturists.

The propagation of the pomegranate in the West Indies, as far as is known by the writer of this article, is only by seedlings. These can never be depended upon to reproduce exactly the characteristics of the parent plant; hence the failure to keep up a good type of plant. It may however be easily grown from cuttings. Hardwood cuttings 10 to 12 inches long, and from $\frac{1}{4}$ to $\frac{1}{2}$ -inch in diameter, cut from the shoots or suckers of a pomegranate tree, will grow readily when planted in the open ground. In this way a desirable variety can be maintained and multiplied. In this way also the pomegranate may be employed to form a most efficient and ornamental hedge. Cuttings set out in a double row, say, 8 feet by 4 feet, and pruned strongly in early stages of growth, will soon form by growth of suckers an impenetrable hedge, and one which in the blossoming season is a thing of beauty.

The pomegranate is no more exacting in its soil requirements than it is in the moisture that it needs. It does best, however, on deep soils, of a fairly heavy nature.

It is not probable that any trade to northern markets in pomegranates will soon be accessible to West Indian growers, although the tough rind of the pomegranate endues it with remarkable keeping powers; yet as a most refreshing and piquant fruit, when of good variety and in good condition, it is to be recommended to more attention on the part of our local horticulturists for local markets.

DATE CULTURE IN CALIFORNIA.

The important feature in the development of this new industry will be to get offshoots of good varieties. France has issued a decree prohibiting exportation of Deglet Noor offshoots to any countries, with the exception of Tunis and Morocco. This variety cannot be secured anywhere else, and such offshoots as can be purchased will be very high in price. There is a question whether offshoots of any varieties can be secured from Egypt in the next three or five years. There are very few varieties from the Persian Gulf region that are worthy of propagation in California, as very few varieties from Persia have been found that are resistant in the climatic conditions in the two valleys in the ripening season.

Thousands of seedlings are beginning to produce fruit, and many of them are producing fruit of good quality, and a larger production is hoped for every year, as the seed is pedigreed pollination from selected males, and results have been gained already that look very promising for the origination of new varieties that will help to build up the industry and bring it to a commercial basis much sooner than could otherwise be accomplished.

There is no question as to the market for all dates grown in California and Arizona, as past experience has shown that when they are placed on the market in a clean, sanitary condition, they are readily sold. (*The Colonizer*, July 1917.)

FOOD CROPS.

PREPARING SWEET POTATOES FOR MEAL.

In view of the likelihood of there being shortage in the supply of imported foodstuffs, general interest has been taken in the West Indies in increasing the production of locally grown vegetables to take the place of imported foods. As a result, there has been in most of the islands a considerable extension of the cultivation of sweet potatoes. With the expectation, therefore, of much larger crops of sweet potatoes, larger, it is to be hoped, than to meet demands of the moment, there is a great need of some method of storing the roots. A disadvantage with this crop is that in its natural condition it can only be kept sound for a short time. Experiments have been made from time to time with the object of removing this disadvantage, and the conversion of the roots into meal has hitherto met the situation to a limited extent. The difficulty is in the slicing of them, and drying them adequately, in order to produce chips or meal sufficiently free of moisture to be capable of storage for a longer period than the untreated roots.



FIG. 1. CHAFF CUTTER ADAPTED AS SWEET POTATO SLICER.

On a recent visit to Antigua, Sir Francis Watts unearthed and had photographed a machine which had been devised by Mr. A. St. George Spooner many years ago for the purpose of slicing sweet potatoes. With this machine, and a simple drying device, Mr. Spooner had carried out experiments on sweet potatoes. The photographs together with Mr. Spooner's notes on his experiment are here reproduced as of interest, particularly at the present time, when the need of being able to store sweet potatoes is a question of some importance. Mr. Spooner writes:—

'The autumn of 1898 was a singularly favourable one for the growth of sweet potatoes in Antigua and early in the following year, when the crop was ripe, the quantity of potatoes for sale in the island was such that it was impossible to sell them at all. At this time I turned my attention to preserving them in the shape of meal for stock or human food. After a few unsuccessful experiments with pulping, etc., I found that the best way of doing this was to cut the

potatoes into very thin slices, after scrubbing them thoroughly clean in water, with a hard scrubbing brush, to remove every particle of dirt, and then to spread the slices on sheets of galvanized iron or wire web, in the sun. The slices dried in six or eight hours in a hot sun, provided they were not thicker than $\frac{1}{16}$ inch. The dried slices were put into old flour barrels, and when enough of them had been collected they were ground into a fine meal in a steam-driven grinding machine that I have imported for experimental purposes.

'I found that slicing with a knife was too slow, expensive, and unreliable, and so devised a slicing machine made by filling in with wood the fly wheel of an old chaff cutter, and just leaving an opening of about $\frac{1}{16}$ inch between the edges of the knives and the edge of the wood filling, or to be more explicit perhaps, making the edges of the knives project about $\frac{1}{16}$ inch forward of the plane of the wood filling, so that the knives would only cut slices of this uniform thickness. A wooden hopper was placed at the knife side of this wheel, after the fashion of a mangel pulper, and filled with potatoes, the weight of which kept the lower ones against the knives as they came round. With this single machine a barrel of potatoes could be cut into slices

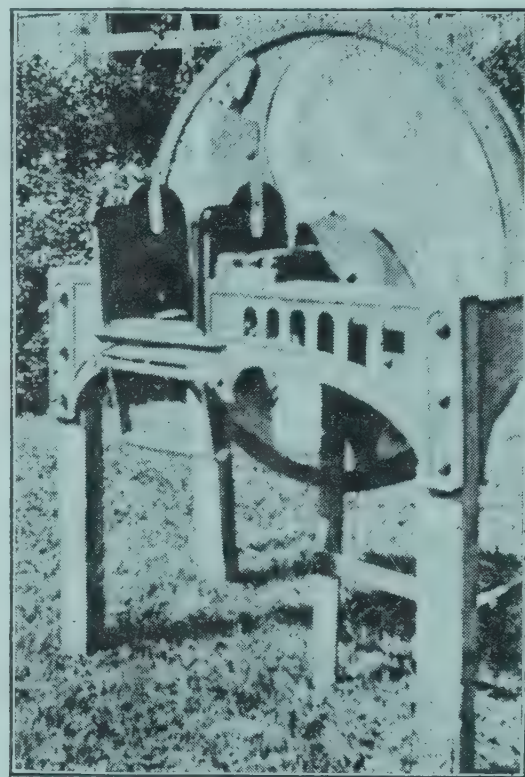


FIG. 2. CHAFF CUTTER ADAPTED AS SWEET POTATO SLICER.

in about a quarter of an hour by one person. It took about 3 barrels of dried slices to make 1 barrel of meal, and a barrel of meal weighed about 160 lb. The grinding mill I have, would turn out a barrel of meal in less than ten minutes, and the expense was very trifling, the machine being driven off the fly wheel of one of the vacuum pan engines in the sugar factory.

'In all I made several tons of this meal, which I used after crop for feeding mules and cattle with satisfactory results.

'The labourers eat this meal readily, but say that it is "very rich". I fancy that in the form of "pap", the only way they tried to cook it, they found they got "stodged" before they had eaten as much as they knew would be about the capacity of their stomachs. I think if they baked the meal with water into cakes they would have been more successful. I have eaten the meal in several forms, and find it a palatable and satisfactory form of food.

The yield of potatoes here is about 4 tons per acre in fair season, and I found I got 40·63 per cent. of meal from them, or 910 lb. meal per ton of potatoes.

Putting potatoes at a fair selling rate here, £1 5s. a ton in the ground, the cost of digging at 3s. a ton, and of delivering at slicing machine at 6d. a ton, the cost of a ton of potatoes at the slicer comes to £1 8s. 6d. This gives 17 barrels of potato slices dried at 5d. a barrel = 7s. 1d. which yield $5\frac{3}{4}$ barrels of meal (910 lb.) at a cost of grinding, in my case, say, of 1d. per barrel. The total cost of 910 lb. meal in my case was therefore about £1 16s. 1d., or about £4 9s. 7d. per ton, exclusive of cost of barrels and cooperage.

If anyone is going in for meal on a large scale, I should think he would do well to try an American fruit evaporator for drying the slices; they must be dried as quickly as possible and quite thoroughly; they must be quite brittle when they are dried, not in the least leathery, or the meal will not keep for any length of time. I lost several lots of slices owing to cloudy weather prevailing when the slices were laid out to dry; the meal from them was tainted, and would not keep properly.

I append a copy of Dr. Voelcker's report on a sample of my meal made in the above manner: "The meal is well dried, containing only 12 per cent. of water and should keep perfectly well. It contains practically 10 per cent. of sugar, with 67 per cent. of starch and digestible carbohydrates, 5 per cent. of nitrogenous or proteid matters, with a not inconsiderable portion of mineral (bone-producing) matter. The percentage of indigestible (woody) fibre is very small".

ANALYSIS.

Moisture	11·99
Nitrogenous matter	5·12
Oil	1·19
Sugar	9·90
Starch and digestible carbohydrates	67·01
Indigestible (woody) fibre matter*	1·89
Mineral (ash)†	2·90

100·00

*Containing nitrogen 82

†Including sand 03

It must be observed that these prices require reconsideration in view of changed conditions. Attention may also be drawn to the fact that chips keep longer than meal in a good condition. It would seem to be better therefore to store sweet potatoes in the form of chips, and to grind them into meal as required for use. It must also be remembered that in the storage of potato products the same precaution against weevils and moulds must be taken as in the storage of grain.

From the foregoing it would appear that appliances such as are used in temperate climates for slicing or pulping mangolds, turnips, and other roots, would serve for the purpose of slicing sweet potatoes for drying.

The Governor of Barbados has issued an Order, dated September 17, 1917, requiring every person owning or having power to sell or dispose of any sugar (whether locally made or imported) or any choice molasses, such sugar or molasses being intended to be sold or otherwise disposed of, and not for personal or domestic use, to make a return in writing to the Colonial Secretary by September 26 of the quantities and qualities of sugar and molasses so owned. Previously to this, by Proclamation dated September 6, the Governor had prohibited the exportation of any sugar from the island, except by special license.

TOMATOES.

The tomato (*Lycopersicum esculentum*) is one of the plants of the New World which have over-run the Old World. Its native habitat being probably Peru, the tomato was not known in Europe until after the discovery of America. In Parkinson's quaint 'Terrestrial Paradise', dedicated to Queen Henrietta, the wife of Charles I, there is a very good description of the tomato, together with quite an accurate wood-cut under the name of 'Love-apple'. After the manner of the old herbalists he attributes to the fruit many wonderful virtues. From the time of its introduction into Europe the tomato has steadily grown in favour as a vegetable, rather than a fruit, and the results of selection by horticulturists have been to develop the original wild tomato—a berry not bigger than a cherry—into a succulent fruit almost the size of an apple.

This fruit has been long valued and cultivated in the West Indies, but there has always been some uncertainty as to results. Imported seed of the best varieties ran to foliage rather than to fruit, except during a restricted season of the year; and even when decent fruit was obtained, the seeds of those fruit tended to revert to the small wild type under the conditions in the West Indies.

In *Agriculture*, May 1917, a journal published under the auspices of the Department of Agriculture, Cuba, there is a very interesting account of some experiments with tomatoes conducted at the Agricultural Experiment Station. The conclusions reached in some directions will be of use to growers of tomatoes in other West Indian islands.

In the first place no less than eighteen varieties were experimented with, one of them being the native small-fruited variety. Only a few of these does the writer in *Agriculture* consider to be worth cultivating under the conditions of temperature, etc., prevailing in Cuba.

The experiments described were chiefly directed, however, to the question of the advisability of, and the results that might be expected from, a system of pruning or training the plants, or both. In these experiments the most suitable and economical form of support for training the plants was found to be a trellis constructed of two or three wires supported on hardwood posts, to which trellis the plants were attached by ordinary twine.

The conclusions reached after two years' experiments are: a uniformly large increase in numbers of fruit, and total weight of fruit produced as the result of supporting the plants over the yield of the control plot of unsupported plants.

Besides the increase in numbers and total weight the average size of the fruit was also augmented by training.

Pruning to various extents, as compared with no pruning at all, generally decreased the crop yield, both as regards total weight and number of fruit.

Pruning, however, resulted in an increase in the average weight of each fruit.

The largest total yield both as regards number of fruit and total weight of crop was from the plots trained on a trellis and unpruned.

The article quoted from goes on to say that the tomato is somewhat sensitive as to its water-supply. Speaking generally the soil should be maintained in a moist condition to obtain the best results. Excessive moisture tends to produce a rank growth of foliage at the expense of fruit production, while lack of moisture will seriously lessen the crop. Judicious irrigation, if practicable, greatly increases the yield, increases the size of the individual fruits, and in some degree hastens maturity of the fruit.

COTTON.

COTTON EXPORTS FROM THE WEST INDIES.

The following table gives the quantity and estimated value of Sea Island cotton exported from the West Indies for the quarter ended June 30, 1917:—

Colony.	Quantity, lb.	Estimated value, £.
Barbados	510	18
Grenada	nil	nil
St. Vincent	28,298	3,157
Antigua	nil	nil
Montserrat	"	"
St. Kitts-Nevis	"	"
Virgin Islands	"	"
	<hr/> 28,808 lb.	<hr/> £3,175

There were also exported to Carriacou from St. Vincent 8,568 lb. of Marie Galante seed-cotton of an estimated value of £89, the ultimate destination being the United Kingdom.

EFFORTS TO PRODUCE LOCAL FOODSTUFFS.

A short description of what has been done in the various British West Indian islands with regard to the increased production of food is here given, as of general interest, now that attention is being paid to the subject.

Not long after the war began a wide-spread feeling of unrest, not to say alarm, was developed in these islands concerning the probable shortage of necessary foodstuffs in the near future. In many of the islands the step was taken by the local Governments of prohibiting any export of foodstuffs, as a precautionary measure, but in all of them this has been followed by efforts to stimulate and encourage extended cultivation of food crops.

In Trinidad there was formed, soon after the war began, with the assistance of the Department of Agriculture and the Board of Agriculture, a Ground Provision Committee. This consisted of voluntary workers, who made appeals and gave suggestions to the agricultural community as to how everyone might become not only a consumer but a producer of food. The Government of Trinidad offered Crown lands for cultivation in food crops at a very nominal rent, while many of the large proprietors freely offered land for the same purpose, some of them also instructing the managers of their estates to plant many acres of provisions.

The result has been that it is estimated that 12,000 acres are now in cultivation under rice, and 23,000 more in other food crops, a total of 7.6 per cent. of the cultivated area of the island.

The neighbouring island of Tobago, which was included in the efforts made by the Ground Provision Committee of Trinidad shows remarkable results; it was able to export to Trinidad in 1915 ground provisions worth £10,274.

In Trinidad, the efforts of the committee noted above had borne good fruit by the end of 1914; but so far as our records go, there appears to have been little co-ordinated effort in other islands until May of the present year. Although the agricultural officers had been exerting them-

selves to induce activity on the part of planters, no general response was made. From May, however, up to the present, there has been much interest shown in all the islands, and the result has been satisfactory.

In Grenada the Agricultural and Commercial Society started a campaign through the island, by holding meetings to urge upon all occupiers of land the necessity of increasing the production of food crops. The Government, through the Agricultural Department, gratuitously distributed seed of various root crops together with seed corn to peasant cultivators, while the larger landowners not only arranged for provisions to be planted to quite a large extent on their estates, but in very many cases granted lands at a nominal rent to tenants who undertook to cultivate food crops. One of the officers attached to the staff of the Agricultural Department was seconded for special duties as Secretary of the committee conducting this campaign; and by the formation of local committees in each parish, who conducted meetings and distributed leaflets on the subject, popular enthusiasm, it may be said, has been aroused. By the end of June the area prepared for cultivation in food crops had so largely increased that it was difficult to supply all the seed asked for, especially in root crops. This however has been remedied, and at the end of August the Secretary reports, as the result of four months' endeavours, that the area planted in ground provisions constitutes a record for Grenada, not only in extent, but also in the careful preparation and good tillage of the land so planted.

In St. Vincent the peasant proprietors and land occupiers had been for some years wisely devoting their attention to the cultivation of food crops, especially corn, peas and beans. The Agricultural Department with additional Government assistance had also been instrumental in the storage of corn to a considerable extent. The Agricultural Superintendent has been directing public notice to the preparation of substitutes for wheat flour in bread making. He has successfully prepared meals from many locally grown foodstuffs, which he has demonstrated can be blended in varying proportions with wheat flour for the production of wholesome and palatable bread. That St. Vincent is able to produce a considerable quantity of foodstuffs is shown by the fact that in the financial year 1915-16 there were exports from the island of corn and peas valued at more than £1,000. In May this year, however, the Government considered it prudent to prohibit any export of foodstuffs from the island. The Agricultural Department is continuing to advocate renewed and increased energy in the cultivation of food crops.

In St. Lucia the situation up to March 1917 is described in the report of the Agricultural Department just issued. In November 1916 a Committee of the Agricultural and Commercial Society was appointed to bring the question to the notice of the Government. The Government advanced to the Agricultural Department £200, since increased to £350, for the purpose of dealing with the question of increased supply of locally produced foodstuffs. Posters were issued and circulars sent out asking for the co-operation of planters and others in the extension of the area planted in such crops as cassava, sweet potatoes, corn, peas and beans. As cassava was largely grown in the island already, and cassava meal is a nutritious food much used by the people, in order to extend its cultivation a factory for dealing with the roots and converting them into meal was erected at the Réunion Experiment Station, where also arrangements were made to deal with sweet potatoes for the same purpose. The result has been a large increase in the acreage under cassava. There seems to be also greater interest taken in the cultivation of other food crops.

In Barbados the first action taken was the prohibition by the Government of the export of articles of food. A Committee of planters later on invited all planters to send in returns stating how many additional acres they would undertake to plant in sweet potatoes. In May 1917, however, the Legislature passed an Act bearing on the subject, which shows that the Government of Barbados is fully aware of the necessity of producing more foodstuffs locally. Seven Commissioners were appointed by the Governor with ample powers to execute the provisions of the Act, the aim of which was to enforce the duty of growing ground provisions on every occupier of 3 or more acres of arable land. The term 'ground provisions' is by definition in the Act made to include corn, peas, beans, and all plants producing crops which provide foodstuffs fit for man. This Act orders that every owner of 3 or more acres of arable land shall, within twenty-one days from the passing of the Act, make a correct return of certain particulars according to a specified schedule. On the receipt of the returns the Commissioners shall send every owner a notice of the number of acres in which he is required to plant ground provisions; the kinds of such provisions, and the number of acres he is required to plant; the time or times at which he is required to plant, and the time or times he is required to reap the crop or crops. The area so requisitioned is not to exceed 10 per cent. of the arable land of any owner.

Inspectors are appointed to see that these orders are carried out, and that the land so utilized is kept in good condition.

The penalty for wilfully neglecting to comply with the directions of the Commissioners is, on conviction, a fine of £10 for every day of such neglect, or if such neglect is not a continuous one, a fine not exceeding £500.

This Act continues in force until March 1918, and by a clause attached to it magistrates are empowered to sentence to be flogged any male guilty of stealing ground provisions.

Barbados is the only island which has taken such strong compulsory measures towards the increase of food supplies.

The result has been, as may well be supposed, a very marked increase in the cultivation of food crops. Probably Barbados has set an example of legislation which the other islands may well follow.

Turning now to the Leeward Islands it may be said that the Agricultural Departments in the various islands have continuously endeavoured to show that it would be of the greatest benefit to cultivate food crops more largely. In June last year the question was brought prominently forward in Dominica. It did not seem however to attract much attention, but in May this year, the Administrator of the island addressed a circular to the planters, pointing out the seriousness of the situation, and requesting them to do all in their power to extend the area under provision crops. Since then there is evidence that much new land is being so cultivated, and it is expected that in a few months there will be an abundance of locally produced vegetables.

In Montserrat the Commissioner of the island sent out in May a circular asking for returns of the extent of land under food crops; at the same time the Government purchased a supply of seed corn and black-eye peas for gratuitous distribution among the peasant cultivators. The planters are now in many instances growing larger quantities of sweet potatoes, and are also stimulating the labourers to grow provisions by renting land for this purpose at a low rate, and in some cases allowing the labourers to use the land without any rent.

In Antigua public attention was directed to the food question early in 1916 by the Agricultural and Commercial Society. Experiments were successfully made in

producing mixed bread from wheat flour and sweet potato meal, and from wheat flour and corn meal, which latter, with the approval of the Medical Officer, has been used in the prison dietary since May 1916, and lately has been much used by the general public. During the early part of this year the Government granary and corn drier have been put into good order, and as soon as the crop of corn is mature, the Government will be prepared to buy corn to be dried and stored. The Central Board for Co-operative Societies is in every direction vigorously pushing the campaign for increased production of foodstuffs, and the officers of the Agricultural Department are taking great pains towards the same end. The Government have offered lands, in some cases free, to peasants on condition that ground provisions are grown. Both owners of estates and peasant proprietors are now planting much land in vegetable foodstuffs, and absent owners of large properties have issued instructions to their attorneys and managers to plant all available land in such crops.

In the presidency of St. Kitts-Nevis the Administrator sent a circular in May this year to all the planters in the islands of St. Kitts, Nevis, and Anguilla, calling their attention to the shortage of imported foodstuffs, and asking that each estate should devote at least one-tenth of its arable acreage to the production of ground provisions. The planters have willingly consented to this, and the result is that it is estimated that at least 1,754 acres will shortly be planted in corn or other food crops. Bread of a mixture of flour and sweet potato meal has met with a favourable reception in St. Kitts.

The Government of British Guiana has appointed a committee to enquire into and report upon the feasibility of local manufacture from the vegetable products of the colony of suitable substitutes for, or adjuncts to, imported wheat flour, and to the possibility of largely increasing the output of the raw materials. This Committee issued an Interim Report on March 10, 1917. The committee reports that meal prepared from rice, Guinea corn, and maize can be employed most efficiently as adjuncts to wheat flour in the making of bread; and that meal from other locally grown crops, such as cassava, sweet potatoes, tannias, and eddoes, together with meal obtained from locally grown pulses, such as pigeon peas, black-eye peas, Lima and bonavist beans can be satisfactorily used in the same way. In order to stimulate largely increased production of such crops as maize, Guinea corn, and cassava, the committee advise that the Government should erect factories for the conversion of such raw materials into marketable products, and that the factories should be worked on a profit-sharing basis between the Government as proprietor and the farmers as producers.

The Sugar Market.—The following remarks on the sugar situation are taken from the last report to hand of Messrs. Gillespie Bros. and Co., dated New York, August 31, 1917:—

The latest news is that the Government will endeavour to fix a price for raw sugars that will enable refiners to sell their products at 7½c. per lb. This would mean that producers must be willing to accept not over 5c. per lb. c. & f. for 96° test centrifugals. It is doubted very much in the trade whether the Cuban growers will accept any such figure, but until a final price basis has been settled upon, trade will be light and prices very uncertain.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial deals with the question of the increase of the production of local food crops as a sound agricultural policy.

On page 294 a résumé is given of the efforts made in the West Indies and British Guiana up to the present to produce more food crops.

The conclusion of the article on some insect pests in Jamaica appears under Insect Notes, on page 298.

Under Plant Diseases, on page 302, there will be found an important article on the Porto Rico cane disease.

Extension of Cultivation in St. Kitts.

The south-eastern end of St. Kitts is a small peninsula, known as Salt Ponds, because of a large lagoon from which in the early days of the colony and even up to recent times a supply of salt was obtained. The land was under cultivation not so very long ago, but for some years past the whole district has only been used as a stock run.

Lately, however, under the direction of Mr. H. Wildy, the cultivation of cotton and coco-nuts has been begun in this long neglected portion of the island. His Honour the Administrator of St. Kitts-Nevis, accompanied by the Superintendent of Agriculture, recently visited Mr. Wildy's new cultivation, and from the report forwarded by Mr. Shepherd, the Superintendent, to the Commissioner of Agriculture, the enterprise is likely to be attended with success.

The chief difficulty in the way was the supply of labour. This has been admirably met by the erection on the spot of houses for the labourers, and of a small store for the purpose of supplying them with food and other necessities.

At the present time there are about 100 acres cleared, 45 acres of which were planted in cotton about May and are most promising, the plants being healthy and vigorous, and bolling plentifully; it is proposed to plant 40 acres more in cotton during the present season. It may be noted that the seed used for this planting is of pedigree seed No. 342 from the Experiment Station at La Guérite in St. Kitts.

There is much more land at Salt Ponds suitable for cotton growing, which it is intended to put into cultivation in the future—not only in cotton, but also in coco-nuts, a nursery of young coco-nut trees having been already established which will soon be fit to be planted out.

It is pleasant to learn of waste and neglected lands in these islands being reclaimed by cultivation, and of labour difficulties being wisely provided against. Everyone who has at heart the prosperity and advancement of agriculture in the West Indies will watch with interest this experiment, and hope that success may attend this and any other similar schemes of development.

The New Economies.

As has been noted in recent issues of the *Agricultural News*, experiments have been made, more or less successfully, in several of these islands of mixing other meals with flour to make bread, in order to economise in the use of imported flour. From the *Louisiana Planter*, for July 14, 1917, the following report of similar experiments is taken. At Audubon Park Sugar Experiment Station, in June, there was exhibited bread made from various materials not commonly used for that purpose. Conspicuous among these was bread made largely from cotton-seed meal mixed with other meal or flour in a sufficient quantity, and in such a manner as to reduce the unpleasant flavour of cotton-seed meal to a negligible point. In the Shulenberg, Texas, oil mill they have been manufacturing cotton-seed meal by a process of their own, and it is called Addison flour. This experiment has been going on there for seven years, and bread

made from this flour has obtained considerable vogue in the country.

It has been the dream of our scientists to realize some way of utilizing cotton-seed meal as human food owing to its high protein content. The results at the Sugar Experiment Station, Audubon Park, are said to have been satisfactory, but still that the diminution of the unpleasant flavour of the cotton-seed meal was presumed to be derived from the diminished proportion of cotton-seed meal in the manufacture of bread. It is not stated as to whether or not the Texas concern is able to remove the unpleasant odour sufficiently to make edible and acceptable bread free of unpleasant flavour.

It is to be noted that caution should be exercised in experimenting with cotton-seed meal for human food: the results of the foregoing and other experiments made under careful conditions will be watched with interest.

Peach Trees in the Tropics.

Peaches are native to temperate climates, but nevertheless, it has been found in Cuba that the Red Ceylon variety does well, and bears heavily the second year and successive years. There is a tree at the Experiment Station at Santiago de las Vegas that was planted more than ten years ago, and it bears every year more or less according to the care it receives. There are many trees planted in the island, some of which, having had good attention, are bearing from 500 to 1,000 native peaches of fair size. The Red Ceylon peach is a small variety, but when it is well grown it is of excellent quality. *Agriculture, Cuba*, May 1917, gives directions for the planting, caring and pruning of peach trees in that climate. These directions emphasize the importance of fertilizing and mulching the ground, copious watering, and severe pruning.

Some peach trees were imported, and planted in the Botanic Station, Montserrat, in 1912. They flowered freely in 1914, but produced no fruit. In 1915 they had got into very bad condition, and the experiment was discontinued. It may be, however, that the varieties imported were not suitable to tropic conditions.

A Noxious Weed.

There are many wild species of the genus *Amaranthus* found in the West Indies, among them the not uncommon and vigorous weed, known in some islands as prickly caterpillar (*Amaranthus spinosus*, L.). In the pastures near Honolulu, Hawaii, and in other parts of those islands, this weed has recently spread so extensively as to cause the Board of Agriculture and Forestry to issue warnings to ranchers and dairymen against this obnoxious plant, advising the use of every possible means to prevent its further spread.

The chief objection to this weed is the fact that it bears a pair of very sharp thorns at the base of the leaves. Cattle will not eat the plant, and they shun the pastures where it occurs. In Hawaii it grows to the height of at least 5 feet, and spreads in an alarmingly rapid manner because it produces seeds, relatively small, in enormous numbers, one plant producing as many as 115,600 seeds. It is important, therefore, to

destroy the plant before the seeds form, in order to prevent the weed from spreading. It is suggested by the *Hawaiian Forester and Agriculturist*, May 1917, that in order to prevent the ruination of pasture land by the spread of this weed it should at once be attacked where found, removing it by the roots, and burning plants, seeds and all.

Forage and Green-Dressing Crops in Rhodesia.

The *Rhodesia Agricultural Journal* for June 1917, contains a report on a number of recent introductions on trial at the Experiment Station, Salisbury. Some of these appear of interest for possible experimentation in the West Indies.

In the first place, as regards hay crops, molasses grass (*Melinis minutiflora*) has proved unequalled for wealth of succulent foliage. At Salisbury the grass forms a dense mat reaching in places to over 3 feet high. A trial cutting in April last gave approximately a return of 5 tons of dried hay per acre. Whether this grass would be successful in these islands, with their hotter temperature, remains to be seen, but it might well be so, seeing that Guinea grass (*Panicum maximum*) has proved very satisfactory on the same station.

Another experiment which met with considerable success, and which might give a hint in growing forage plants in the West Indies, was growing Guinea grass alternatively with one or more legumes, the idea being to give a greater variety of food, and, by the inclusion of legumes, a more complete ration.

Among experiments on plants suitable for green dressing, one with the sunn hemp (*Crotolaria juncea*) gave good results. This plant is largely grown in India for the sake of its fibre. It has no value as fodder for stock, but its root system being usually covered with nodules, its value as a green dressing is favourably reported on. This plant is grown very commonly in gardens in these islands, for the sake of its showy flowers. It grows easily and luxuriantly, and although a trial on a small scale as a green dressing in St. Vincent was not particularly encouraging, further experiments might show it to be of value for the purpose.

Bread from Mixed Meals, and the Preparation of Yeast.

Mix together 2½ teacupfuls of flour with 2 teacupfuls of maize meal. Prepare a mixture of 2 cupfuls of water to 1 of the mixture of flour and meal to bring the dough when kneaded to the usual consistency. The dough is then left in a dish overnight and thoroughly kneaded the next morning, after which it is put into two bread tins and allowed to rise in the usual way. The yeast is prepared by taking 1 tablespoonful each of sugar, salt, and flour, and mixing with a handful of hops in a dish. To this mixture add about 2 quarts of boiling water, and allow the whole to stand for about twelve hours. The liquid or yeast is then poured into bottles and corked. The sediment remaining in the dish is of no use and can be thrown away.



INSECT NOTES.

SOME INSECT PESTS IN JAMAICA.

(Concluded.)

In the last number of the *Agricultural News* some of the more important insect pests in Jamaica were reviewed under their host plants, as set forth by Mr. A. H. Ritchie, the Government Entomologist. These notes are concluded in this number.

CORN. The leafhopper (*Peregrinus maidis*) was responsible for considerable damage to corn, causing a withering of the leaves and producing a general stunted appearance of the plants. The hopper is usually found associated with a species of aphid or plant louse (*Aphis maidis*). Various flies and beetles are attracted to the sweet excretions of these pests. Among the natural enemies of this leafhopper are two ladybird or coccinellid beetles, *Scymnus ochroderus* and *Coccinella emarginata*. A parasitic fungus known in Hawaii as a 'sterile cordyceps' also attacks this hopper.

SWEET POTATO. This crop is attacked by several different kinds of beetles, the following being the most important: (1) One of the so-called 'flea-beetle' (*Chaetocnema apricaria*) which feeds on the upper epidermis of the leaves, cutting serpentine channels but never eating right through. (2) A species of 'tortoise-beetle' (*Coptocycla flavolineata*) which eats out large portions of the leaves both of the sweet potato and of the related wild species of *Ipomaea*. (3) The scarabee (*Euscepes batatae*), and (4) the sweet potato weevil (*Cylas formicarius*), the grubs of both of which feed on the tubers and sometimes attack the vines. These last two pests can be controlled by planting clean slips from uninfested tubers, by rotation of crops, and by a general clean up of refuse after the crop.

It may be added that *Cylas formicarius* is not known to occur in the Lesser Antilles, but is a pest in Jamaica, British Guiana, Cuba, the Bahamas, and in some of the Southern United States, chiefly the Gulf States. The *Quarterly Bulletin of the State Plant Board of Florida* (Vol. I, No. 2, January 1917) mentions that this weevil has recently been found to occur in one of the northern as well as in two of the southern counties of the State. Recent correspondence from the Entomologist of the Mayaguez Experiment Station, Porto Rico, mentions the fact that *Cylas formicarius* occurs in that island, but is apparently confined to the eastern portion.

BEE KEEPING. Mr. Ritchie states that so far as is known neither the European nor the American foul brood disease of bees exists in Jamaica, and strongly urges against the importation of queens, and against the keeping of antiquated, insanitary box-hives. This type of hive makes the detection of the above bee disease very difficult if not impossible, and at the same time is ideal for harbouring the wax moth (*Galleria mellonella*), which is very prevalent in Jamaica.

MISCELLANEOUS INSECTS.

Under this heading Mr. Ritchie mentions several insects, the most important of which is the black weevil of bananas (*Cosmopolites sordidus*). Experiments which are being

suggested for the checking of this pest include deep planting and the application of repellent substances around the base of the plants. Attention is called to the presence of a beneficial grub of *Pyrophorus* sp. in infested bulbs. *Pyrophorus*, it may be remembered, is one of the large luminous beetles or 'fire flies' found in some of these islands, and one species has been observed to be predaceous on hard back grubs in Porto Rico. (*Agricultural News*, Vol. XVI, No. 299, August 11, 1917.)

The introduction into Jamaica of two species of predaceous histerid beetles is being considered. One of these is an enemy of *Metamasius hemipterus* in Trinidad, while the other histerid, *Plaesus javanus*, helps to control the black banana weevil in Java. Within the last three years this beetle has been introduced into Fiji from Java in the hope that it will prey upon the banana weevil in those islands. The subsequent result of this experiment in Fiji is not known at present.

The lily caterpillar (*Xanthopastis timais*) sometimes destroys plants belonging to the family Amaryllidaceae or lily group. Observations were made on this species by William Jones, a former naturalist of Jamaica, who lived in the first half of the last century. He noticed that when small the caterpillars 'arrange themselves side by side like detachments of horse soldiers.' Those who are familiar with this caterpillar in these islands will probably have observed that the older caterpillars no longer retain the habit of close formation, but scatter in all directions over the plant. They usually end by devouring all of the plant above ground and often burrow down and destroy the bulb. The dusting of the plants with stomach poisons, such as Paris green or arsenate of lead, or the collection of the caterpillars while they still have the clustering habit, can be recommended to control this garden pest.

STOCK PESTS.

A rather serious outbreak of the horn fly (*Lyperosia irritans*) occurred in one district in January 1917. There are two classes of pasturage in this district, namely, Pimento grass commons, and mixed Para and Guinea grass pastures. The horn fly, it may be noted, breeds in manure, and Mr. Ritchie considers that with a well distributed or even rainfall, both types of pasturage would no doubt favour the breeding of the horn fly, but that the manure dropped in the Pimento grass would tend to dry out rapidly enough to check or even prohibit the breeding of the horn fly. On the other hand, the longer grass in the mixed pastures would shade and protect the manure from drying out by sun and wind. Towards the end of 1916 this district had a long spell of continuous rains which no doubt contributed largely to the sudden increase of the horn fly at the beginning of 1917. With the coming of warm and dry spells the numbers of the horn fly are considerably checked.

The scattering of the manure in the fields hastens the drying out process, and it was noticed that a species of large black dung beetle (*Phanaeus sulcatus*) was of great assistance in the drying out and deep burial of the manure in the fields. Mr. Ritchie suggests the exchange of such beneficial forms with other entomological stations.

The outbreak of the horn fly caused serious wounds on the shoulders and backs of the cattle which required systematic dressing. The screw-worm fly (*Paralucilia macellaria*), and other flesh flies were attracted, but the careful supervision which is possible with the small herds in Jamaica kept these pests down.

The systematic control of ticks on cattle by the adoption of dipping vats is strongly urged, and this is especially important since cattle kept free from ticks will be better able to

resist an outbreak of the horn fly. Mr. Ritchie says that the control of ticks in Jamaica by dipping and spraying is rapidly being taken up.

The use of repellents in grazing pens cannot be recommended at present, although some such means may be employed to afford relief to a dairy herd during milking time. Such strong smelling substances as fish oil, carbolic acid, pine tar, etc., are in general use in many countries for keeping flies from cows, but these repellents give only temporary relief and have to be renewed every day or two.

J.C.H.

AGRICULTURE IN BARBADOS.

The month of August closed with a comparatively moderate rainfall, and the last heavy general rain fell on the 23rd of the month, when there was rain the whole day.

We, however, need at this time of the year a liberal supply of moisture, as, at this stage, the cane plant grows with great rapidity.

September has opened with light showers only, and some of the days have been very sultry. Up to the present the rainy season has not brought us any bad weather. The winds have been quite ordinary, and, except for a slight southern breeze now and again, we have had no reminder that we are passing through what are known as the stormy months of the year.

Efforts are being made to put out of hand field after field in preparation for the next planting season. On some estates, notably in the red soil, the cultivation presents a very pleasing appearance. The more extensive the tillage the better. The return is always heavier where there has been no stinting, to use a common expression, in the 'handling of the soil.' Some estates, for many years past, have discarded draining altogether, but several planters have told us that they will have to resort to it again. It was discontinued, no doubt, to reduce agricultural expenses when the price of produce was below a remunerative figure, but now that this is not the case it would be distinctly advantageous to reintroduce a form of tillage which was productive of much good to the soil. There was also the regular practice of moulding slopes. Some planters tell us that they would be glad to do some moulding this season, but labour is insufficient. This is a pity. It is of the greatest value to spread new mould on the surface, and years ago the labourers found this work more remunerative than many another task.

The fair weather has been most favourable for ploughing, forking and weeding, and in some fields there has been a disturbing amount of pond grass to be got rid of. It does seem as though this grass in particular, is much more abundant than it used to be. The mere uprooting of it is of no avail. Each field should be thoroughly picked and the disturber entirely removed. It is a waste of money and of labour to proceed otherwise. But apart from the increased expenditure in a single year, caused by partial weeding, there is the leaving in the field of grass plants which develop rapidly as soon as the growing crop has matured and been removed from the land. There is, too, the old proverb that 'one year of seed makes three years of weed.'

The pens of manure which were completed a few weeks ago are being rapidly distributed and new pens are being built up. Scientific accuracy is necessary in dealing with the distribution of farmyard manure. After a certain time there is a rapid loss of nitrogen. Wastage in the properties of manure is, no doubt, sometimes the cause of the unsatisfactory

condition of a certain field which is said to have been treated in exactly the same way as the other fields cultivated during the same season.

One of the most important details in connexion with the growing of a crop is its manurial treatment. It is here that scientific knowledge may be of much assistance, and it is worth while studying those processes and conditions which lead to the best results. The condition of farmyard manure at the time of its application is an important matter, but we would on this occasion, mention one other detail which is not infrequently overlooked. A light soil should always have applied to it thoroughly rotten manure. The soil mixes with it more easily, and the trying effect of a drought is lessened. The soil is consolidated, and its power of retaining moisture much increased by its mixture with the rotten manure. While in the case of a heavy soil, freshly made manure is more beneficial, the soil is greatly lightened and made more pervious to air and water.

The question of resting soil is also a point to be considered. A fallow year is a most effective means of renewing the productive power of the soil. The increase of humus in the soil, valuable as this is, is not as beneficial as rest.

The potato crop in the black soil is healthy and a good yield is anticipated. In the red soil the yield will be, generally speaking, moderate to poor. After the growth of three and sometimes four crops of canes there is but little left in the soil to support a crop of provision of any kind without the assistance of manure.

Several fields of potatoes on estates in the red soil have been sold during the past fortnight at 1½c. per hole, while in the black soil the return in many instances has been such as to command a price of 8c. per hole. (The Barbados Agricultural Reporter, September 8, 1917.)

RECIPES FOR MAKING BREAD WITH FLOUR SUBSTITUTES.

As a practical corollary to the subject of local food supply which is dealt with in this issue, the following is taken from the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, issued August 13, 1917:—

BAKING POWDER BREAD.

Take ½-lb. of banana or other meal, ½-lb. of wheaten flour, half a teaspoonful of salt, and one and a half teaspoonfuls of baking powder. Mix all thoroughly, and then add enough cold water to make a rather moist but not too wet dough.

Do not knead but put into a well-greased tin and bake at once in a moderate oven for about an hour. If the dough is allowed to stand for even a very short time after mixing it will become sodden and heavy.

YEAST BREAD.

Take a small quantity of yeast and about half a teaspoonful of brown sugar and a tablespoonful of wheaten flour. Mix this with warm water to the consistency of thick cream. Allow this mixture to stand in a warm place for two or three hours to form a sponge. Make a mixture of ½-lb. of wheaten flour, ½-lb. of banana meal, and half a teaspoonful of salt; knead this thoroughly into the sponge to make a stiff dough. The kneading is very important. Place the dough in a well-greased tin, and stand in a warm place for two or three hours to rise again. When the loaf has risen to about two and a half or three times its original size, bake in a moderate oven for about an hour.



GLEANINGS.

The *Bulletin of the New York Botanical Garden*, issued July 10, 1917, contains a flora of the island of Vieques, which is situated about 7 miles south-east of the eastern end of Porto Rico, compiled by Percy Wilson. The flora of Vieques is essentially similar to that of Porto Rico, but there are elements which link it with the Virgin Islands and St. Croix.

It is now known that 226 different disease organisms are carried by insects to man or animals, 282 species of insect carriers being concerned. Dr. L. O. Howard in his presidential address to the Washington Academy of Sciences regards the transmission of pellagra by the insect *Simulium* as definitely disproved, and considers it unlikely that infantile paralysis is an insect-borne disease. (*Nature*, July 12, 1917.)

The annual report of the agricultural and industrial statistics of the Louisiana Department of Agriculture and Immigration for the year 1916 states that 'two new aspirants for agricultural honours in Louisiana have made their appearance; the soy and velvet beans, and from the large quantity that is being planted this year there is an indication that these legume crops will reach 1,000,000 acres in 1918, adding \$20,000,000 to the State's agricultural resources.'

At the suggestion of the Imperial Institute, cultivation trials have been carried out in the Seychelles with the ajowan plant as a source of the antiseptic thymol which used to be imported into Great Britain from Germany, the seed necessary for these trials having been specially secured and sent to the Seychelles by the Imperial Institute. Samples have recently been received at the Institute of ajowan seed grown in the Seychelles. On analysis the product has given a satisfactory yield of thymol. (*The Board of Trade Journal*, July 12, 1917.)

Analyses made at the California Experiment Station of dry banana stalks obtained from fruit markets, showed that they contain as much potash as kainit, and compare favourably with dried kelp as filler for commercial fertilizer. Charring and leaching of banana stalks yielded 27 lb. of 90 per cent. potassium carbonate per ton. The possibility of collection and treatment on a small scale of banana stalks as a source of potash is suggested. (*Experiment Station Record*, Vol. XXXVI, No. 9.)

The Agricultural Commission appointed by the Government of British Honduras, to enquire into and investigate certain matters and conditions relative to agriculture within the colony is at work with apparently good results. The *Clarion* of British Honduras, July 26, 1917, says, 'we believe that the Agricultural Commission has already demonstrated the good judgment of the Government in its appointment, and we feel sure that the outcome of its labours will be an improvement in agriculture and the status of the agricultural population of the Colony.'

A set of examination papers for the registration of chemists in Mauritius, 1916, appears in the *International Sugar Journal*, July 1917. There are five papers of varying length given in the Journal: Agricultural Chemistry, Bio-Chemistry, Sugar-house Chemistry, Sugar-house Control, and Practical Chemistry. They appear to expect a high standard not only theoretical but practical, especially those on Sugar-house Chemistry and Sugar-house Control. The Journal unfortunately omits to state under what authority the examination is held, or who is responsible for setting the papers.

Java is fortunate in having wonderful facilities for irrigation. The water carries a slimy silt which is a manure in itself. The system of irrigation is conducted by the Government, which only charges the planter 2s. 6d. per acre per annum. Nature helps the planters to a considerable extent by giving them flat country. Irrigation is really the outstanding feature of the sugar-cane cultivation in Java, and it is thoroughly well organized. In addition to the system of Government irrigation, the Government assists the planters by experimental stations, and by co-operating with the mills, and assisting the sugar industry in every way in its power. (*Agricultural News and Sugar Planter's Gazette*, Durban, June 15, 1917.)

The formation last year, under the chairmanship of Lord Milner, of an agricultural section of the British Empire Producers' Organization was a natural and important step, for there is no industry in which the different parts of the Empire have a closer common interest than agriculture. The Committee wisely invited and obtained the co-operation of our Overseas Empire; and it is the intention, on the strong foundation of complete representation, to proceed with the building up of a scheme which will encourage economic and bountiful production of essential commodities, and in this way develop and mobilize the agricultural resources of the Empire. (*The Times*, July 5, 1917.)

The *Dominica Chronicle* for August 29, 1917, in the report of the meeting of the Chamber of Commerce expresses the dissatisfaction of the shippers of green limes to New York, at the protracted length of voyage which sometimes occurs on the boats of the Quebec Steamship Company. The Chamber of Commerce has drawn the attention of the Company to this matter. A recent shipment of Dominica limes had been about thirteen days on the vessel, the steamer having spent four or five days taking sugar at islands farther north. The Chamber of Commerce suggests that the company might alter their schedule of callings, as they have done before this, so as to make Dominica their last port of call, when it is intended to take sugar at St. Croix.

The Committee appointed by the Government, to investigate the best means of developing the cultivation of cotton within the Empire, held its first sitting at the Board of Trade Offices in London on July 25. A deputation from the Lancashire cotton trade, which waited upon Mr. G. H. Roberts in February last, urged the vital necessity of growing more cotton within the Empire, and were successful in securing the setting up of the present committee, but no financial assistance was promised by the Government. Among the cotton trade representatives on the committee are Messrs. J. W. McConnel, of the Federation of Master Cotton Spinners' Association; J. Arthur Hutton, British Cotton Growers' Association; and C. M. Wolstenholme, Liverpool Cotton Association. (*The Manchester Guardian*, July 27, 1917.)



ST. LUCIA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1916-17.

St. Lucia is evidently coming to the front in the cultivation of limes, as is evidenced by this report. During the year under review, there were 25,083 lime seedlings distributed from the Department's nurseries. This was not sufficient however entirely to meet the demand, for owing to a very unfavourable wet season considerable difficulty was experienced in raising lime seedlings, successive sowings having been destroyed by the 'damping off' fungus.

The progress of the lime industry is also shown by the fact that whereas in 1914 the lime crop was estimated at 12,765 barrels of fruit, the crop of 1916 was estimated at 22,489 barrels. Of this 3,403 barrels of green limes were exported to New York, the St. Lucia green limes having gained a reputation in that market for well packed fruit. It is to be hoped that care be taken to prevent the standard being lowered by careless shipment of fruit of inferior quality.

Another testimony to the development of the lime industry is given by the large extension that has had to be made in the Government Lime Juice Factory. By careful forethought in planning the extension it was possible to install the whole of the new machinery without dismantling or discarding any part of the old plant; and moreover the extension was carried out without interfering on any occasion with the daily working of the Factory. The plans of the extended factory, which accompany the report, are very clear, and might well be of use to any one desirous of erecting an up-to-date factory for dealing with lime products.

With regard to sugar, the report shows that the value of sugar exported from St. Lucia has almost doubled in two years. This however is not due to any great increase in acreage under sugar-cane, but to the great rise in prices.

The cultivation of cacao seems to have remained much in the same position as for some years past; but there has been a marked increase in the cultivation of coco-nuts, and in the value of the exports of nuts.

The cotton cultivation seems to have been practically discontinued in St. Lucia. Probably the abundant rainfall over most of the island, coupled with a short labour supply, renders cotton an unsuitable crop.

Among minor industries there has been a marked development in the manufacture of bay oil, the proprietary factory for the distillation of this product having been considerably extended. In 1914 only 40 gallons of bay oil were exported, whereas in the year under review the exported quantity was 606 gallons.

Bee-keeping has received more attention, with the result that 45,588 lb. of honey were exported in 1916, as compared with 29,338 in the year before.

Probably the trade in fruit, such as oranges, mangoes and bananas, to other islands, especially Barbados, which does not grow fruit enough for local consumption is capable of considerable extension.

In common with other islands St. Lucia has had to face the problem of the threatened shortage in breadstuffs imported from the United States and Canada. The steps taken to increase the cultivation locally of such articles as might supply deficiencies of wheat flour and maize have led to good results, especially with regard to cassava. This vegetable is largely grown by the peasants, and, when manufactured into farine, forms one of their chief articles of diet. In order to extend its manufacture, the Agricultural Department has erected at the Experiment Station, Choiseul, a building 30 feet x 20 feet x 18 feet, and equipped it with a battery of farine pans, together with a large grating mill, slicing machine, and flour mills, which have given satisfaction as to working capacity. In the district of Choiseul there are about 150 acres under cassava cultivation, estimated to yield 400 tons of farine annually, and it would be possible to increase the area to 300 acres, the produce of which would be of considerable value as a substitute for certain imported foods. Not only, however, is the utilization of cassava flour being encouraged, but the manufacture of sweet potato flour is being undertaken on the Experiment Station at Réunion. Considerable additional areas have been planted in sweet potatoes, the crop of which will be treated and dried at Réunion, and then ground into flour at the Government Lime Juice Factory, a suitable mill for the purpose having been lent by the Cul-de Sac Company.

Agricultural instruction in the primary schools of the colony evidently receives attention. This is all to the good, especially if the school gardens are made of real educational value. The work of this nature in the elementary schools in St. Lucia is probably more effective than in any of the neighbouring islands. This is largely due to the interest taken by the Agricultural Department in this matter for many years past, as is shown by former reports. It is important to note that an officer of the Department regularly examines and advises the schools in this connexion.

As another incentive to intelligent cultivation of two important crops, viz., limes and cacao, a prize holdings competition has been reviewed. The competition is limited to persons holding not more than 20 acres of land; in the case of limes the competition is for a period of two years, in the case of cacao the period is one year. The prizes will be awarded on points obtained by attention to essential conditions of good culture.

St. Lucia is much more interested in various crops than in stock raising, but praiseworthy efforts are being made to improve and extend this industry. It is a matter of moment to stock farmers that experiments at the Agricultural Experiment Station have demonstrated that ticks can be controlled completely by the use of Cooper's Cattle Dip and Cattle Tick Grease.

The part of the report which deals with the working of the Agricultural Credit Societies is very interesting reading. Notice has already been taken of this subject in the *Agricultural News*, No. 401. It is evident that the co-operation of peasant proprietors under the conditions of the Agricultural Credit Societies Ordinance has met a long-felt want, enabling the industrious peasant to obtain temporary financial assistance on a sound business footing, and at a reasonable rate of interest.

The whole tone of this report is very cheering; it tells of real progress. In order to estimate rightly how real this progress is, it is only necessary to compare this report of the Agricultural Department with earlier ones, say, of ten or twelve years ago. St. Lucia is evidently awaking to the importance of agriculture to the whole community, and is apparently advancing on well planned lines which must conduce to the prosperity of the colony.

PLANT DISEASES.

THE PORTO RICO CANE DISEASE: COMPARISONS.

The curious disease of sugar-cane which has appeared in Porto Rico, an account of which was given in the latest issue of this Journal, affords for consideration a subject of more than ordinary interest. According to the information supplied the infection is steadily extending, is transmitted in all the cuttings made from affected plants, and is transferred to plants of healthy origin brought into the area of its occupation. Yet no parasitic organism has been found to which its origin can be attributed.

A comparison with the sereh disease of sugar-cane of the Eastern Tropics is at once suggested. Sereh was first definitely reported in Java in 1882, and in the period 1882-96 it extended steadily and regularly from west to east of the island, which it occupied with the exception, still remaining, of certain highland regions. The disease is now avoided partly by the establishment of a system under which cuttings are regularly imported from these districts to the plains, and partly by the propagation of more resistant varieties. The transfer of cuttings from an infested to a non-infested district was found to give rise to a new centre of sereh, even though the plants so introduced were not further propagated. Plants raised from healthy cuttings from the disease-free districts become infested in their first year in the plains. No specific parasite has been found to explain the transmission thus implied.

So far the parallel with the Porto Rico disease appears to be a close one, and there is a further resemblance in that the primary diseased plants may show very little sign of the disease. The characters which are revealed in the second generation are however quite different from those of the Porto Rico disease. In sereh the canes have very short joints, numerous aerial roots, and buds which sprout prematurely and so give the resemblance to lemon-grass from which the disease derives its name. In the third generation of diseased plants a whole cane field may look like a field of lemon-grass with here and there a cane stalk arising from the clusters. Ratoons are almost invariably badly attacked.

Another disease which occurs on sugar cane in Java, the yellow stripe disease, apparently belongs to the same class as sereh and the Porto Rico disease, and has in common with the latter the character of affecting the colour of the leaves. It is characterized in most varieties, according to the description given by Dr H. M. Quanjer, 'by the development of yellow stripes on the leaves and red stripes on the stem; the internodes do not exhibit their full growth; in severe cases the plants are slender and the yield may be reduced to nearly half the normal. The disease has been known for more than twenty years in Java; it occurs on all types of soils and in all varieties except the wild ones. The diseased plants appear scattered in the plantation; organisms could not be demonstrated to be its cause.' Diseased cuttings invariably give diseased plants. Healthy stocks give a greater or less percentage of diseased offspring.

Perhaps the most instructive comparison that can be suggested, since it refers to an affection which has been the subject of many-sided investigation and has a voluminous literature, is with the leaf-roll disease of the common potato. The recent lucid exposition of its characters by Quanjer will be followed in the ensuing remarks. The principal symptoms are rigidity, discoloration, and upward rolling of the leaves, slow growth, shortening of the internodes, and the production of small tubers. Plants may become primarily affected

during the course of the growing season, in which case they may show the effects of the disease slightly or not at all. As in sereh, however, the next generation following the beginning of the affection consists of plants of which the greater part are diseased from the outset. The second, third, and subsequent generations show the same type of secondary disease in all the plants. A spontaneous disappearance of the symptoms in a long series of succeeding generations has never been observed, nor, on the other hand, has the extinction of the progeny occurred.

By a series of experiments Quanjer has shown that the disease is definitely contagious. He indicates the difficulty of learning this fact from general observation, and expresses the belief that it is for this reason that the communicability of sereh has never been definitely proved. His results may be briefly set out as follows: (a) Tubers from healthy 'elite plants' of two strains, planted where leaf-roll was prevalent, showed late signs of the disease in the first summer. Parallel plantings on the original farm remained normal. (b) In grafting experiments the disease was communicated from diseased stocks to healthy scions and vice versa. (c) Attempts to introduce the disease into healthy plants by injecting them with the sap of diseased plants or by transplanting tissue from diseased stalks were unsuccessful. Similarly in transplanting pieces from one tuber to another, infection did not occur where union was not secured. (d) Union of opposed halves of infected and non-infected tubers resulted in the issue of diseased stalks from the eyes of the latter. (e) Infection may start from the soil in which diseased plants have grown, and in one instance was shown to take place after five years interval in soil rich in humus and untilled during the period. (f) The disease is transferred to adjacent plants. (g) It is as yet uncertain whether the disease can be transmitted through sexual reproduction.

According to Quanjer, the essential character of the disease, from which the external symptoms arise as secondary effects, is necrosis of the phloem, i.e. decay of those strands in the vascular bundles whose main function is conduction of the elaborated products of the activity of the leaves. No causative fungus or bacterium has been found, so that the occurrence of contagion leads to the hypothesis that a virus is concerned which is either a fluid or composed of organisms too small to be rendered visible by the microscope.

The mosaic disease of various Solanaceous plants is known to be communicable by means of a virus which has resisted all attempts at filtration, and of which the infective efficiency is not reduced by dilution of the juice of the diseased plant to 1 part in 1,000 and still exists in a dilution of 1 in 10,000, although no more is introduced in making an inoculation than is carried on the point of a needle. Since the result of such an infection is conveyed to all parts of the plant and may be increased indefinitely by further transmission to other plants the conclusion that it is in some way propagated in the plant is irresistible.

No such infective virulence has been found in the potato leaf-roll disease, in sereh, or as it appears, in the Porto Rico disease, but the idea that the existence of a contagious virus may account for the recorded facts of the transmission of these diseases is supported by the knowledge of the possibilities in this direction which the more definite properties of the virus of mosaic disease have permitted to be demonstrated.

It will be interesting to learn if phloem necrosis, which has been asserted (and denied) to be an essential character in several so-called physiological diseases, occurs in the affected Porto Rico canes.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. LUCIA. The Agricultural Superintendent, reporting for the month of August, states that the distribution of plants from the Experiment Stations included the following: lime 6,625, oranges 14, economic 4, grafted mangoes 19, cacao 300, ornamental 130, sweet potato cuttings 5,000; vegetable seeds 102 packets. Work in the Botanic Gardens was of a general routine character.

Regarding staple crops, Mr. Brooks states that the cacao crop was promising, but the market poor. The lime crop was still heavy, and the extension of the area under limes continued; while the sugar crop was promising, under the circumstances: the shortage of ammonia for use as a fertilizer is felt very much. Under the head of pests, canker was reported as fairly common.

Considerable attention was given to agricultural instruction in the country districts; 103 estates and holdings were visited during the month. The Government Lime Juice Factory was working at full pressure; 50 casks of concentrated juice awaited shipment.

Referring to the weather, it is noted that the average velocity of the wind at Réunion during the month was 7.3 miles per hour. The rainfall at the Botanic Gardens, Castries, was 10.09 inches; and at the Agricultural and Botanic Station, Choiseul, 7.96 inches.

A further loan of £100, making a total advance of £350 has been approved by His Honour the Administrator to enable large areas of ground provisions to be planted at Réunion. This work will proceed by stages to supplement the food supply during the months of January to June, when ground provisions are generally scarce.

MONTSERRAT. During the month of August the following plants were distributed: lime plants 500, bay plants 200, Bengal beans 36 lb., sweet potato cuttings 240, peas and beans 13 packets; in addition, 8 bags of seed corn (cobs) were sent to St. Croix, and 3 bags to Barbuda. In the Botanic Gardens, in addition to work of a general routine nature, operations included five distillations of bay leaves, making a total of 4,000 lb. leaves reaped from the Chateau plot to date.

In regard to staple crops, Mr. W. Robson the Curator, states that weather conditions, on the whole, have been satisfactory for cotton. The rainfall in the leeward district was, as usual, heavier than at the windward. There was at leeward a considerable area showing, but not in a very marked degree, the condition known locally as 'chibble', when the growth attenuated and the leaves crimped.* It occurred on late planted fields and may, Mr. Robson suggests, have been caused by excessive rains in the early stages of growth. Picking was in full swing, and growers seemed satisfied with the prospects for the crop. Frequent dusting had been necessary to keep the cotton worm in check, but there had been no report of cotton stainers becoming numerous anywhere. Nineteen pounds of dried growth of *Datura Metel* was sent to the Imperial Institute for examination.

The rainfall recorded at Grove Station on twenty-four days for the month was 7.12 inches; the total rainfall for the year to date was 40.71 inches. There was an absence of high winds, and plenty of sunshine during the month.

DOMINICA. In his report for the month of August the Curator, Mr. Joseph Jones, states plant distribution

to have been as follows: limes 5,408, budded citrus 6, grafted mangoes 3, nutmegs 2, shade trees 200, miscellaneous 148, making a total of 5,767. In addition, 132 packets of vegetable seeds were sold.

The lime crop is reported to have reached its maximum. The present local price of ripe limes was 4s. per barrel in Roseau and 3s. per barrel in country districts. The price of green or fresh limes was 6s. per barrel. Eleven thousand dasheen heads and 500 tania heads were forwarded to Portsmouth for free distribution to certain peasants requiring same for planting purposes; while 36 lb. of Bengal beans were imported for a planter. Mangoes have been badly attacked this season by the mango worm, which has caused great loss of fruit.

The Permanent Exhibition Committee shipped 49 boxes of limes to London for the use of wounded soldiers in hospitals. At the request of the Director of the Lister Institute of Preventive Medicine, London, small boxes of fresh and ripe limes have been forwarded from time to time in order to assist in experimental work in regard to lime juice, the object being to institute a comparison between the value of fresh limes and preserved lime juice.

The weather during the month was normal; the rainfall for the month equalled 8.63 inches.

ST. KITTS. It appears from the report of the Agricultural Superintendent, that work in the Experiment Stations during the month of August consisted chiefly in the reaping of crops. Plant distribution included—peas 5 lb., Mazzagua Guinea corn 3 lb., Indian corn 24 ears, sweet potato cuttings 900, and a large number of onion slips. In addition, 5 lb. of *Carum copticum* seeds were sent to the Laboratory, Antigua. In the Botanic Gardens general routine work was carried on. The very dry weather during the month made constant watering necessary, and the plants were feeling the effects of it.

The dry weather of the past month had considerably affected the cane crop, and little progress, if any, had been made, especially in the ratoons. If the much needed rains do not come soon, the prospects for next crop, Mr. Shepherd fears, will be very poor. Where artificial manures have been supplied to the ratoons, there has not been sufficient rain to show any results. In many cases no manure has yet been supplied. The cotton crop, on the other hand, presented a fine appearance, and the prospects of a good return were very hopeful. Picking had commenced on many estates, and the weather was very suitable for this. There had been no pests to speak of in the cotton crop; worms had been singularly absent, perhaps due to the early planting, and leaf-blister mite, so far, had not been troublesome. Special cotton work was being done, counting flowers in plots and marked plants in manurial plots.

A meeting of the Agricultural and Commercial Society was held on August 24, at which a resolution was passed to continue the support of the Society to the work of the British Empire Producers' Association, and inviting subscriptions. The rainfall for the month was 3.07 inches; for the year to date, 22.85 inches.

Appended to this report is a summary of work conducted at the Government Laboratory, St. Kitts, during the month of August. This included analysis of nineteen samples of milk from the Inspector of Police; determining the manurial value of a mixture of lees and ashes; examination of three samples of rum; analysis of a sample of pen manure; determining the feeding value of corn cake meal; examination of a sample of kerosene oil; field work with cotton, and physical analysis of one sample of soil.

*This is the affection described as curly leaf in the *West Indian Bulletin*, Vol. XIV, p. 315.—Ed. A.N.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
July 26, 1917.

ARROWROOT—5d. to 7½d.
BALATA—Block, 2/9- to 3/4½; Sheet, 3/10½ to 3/11.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 41d. to 45d. per lb.
FRUIT—Bananas, no quotations; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
ISINGLASS—No quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—1/3 per lb.
NUTMEGS—10½d.
PIMENTO—3¾d. per lb.
RUBBER—Para, fine hard, 3/2½; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., August 8, 1917.

CACAO—Caracas, 12c. to 12½c.; Grenada, 11½c. to 12c.; Trinidad, 11½c. to 12½c.; Jamaica, 9½c. to 9¾c.
COCO-NUTS—Jamaica and Trinidad selects, \$32.00 to \$33.00; culls, \$22.00 to \$23.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 75c. to 80c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 65c. to 70c. per lb.
GRAPE FRUIT—Jamaica, \$2.75 to \$3.50 per box.
LIMES—\$6.50 to \$7.00 per brl.
MACE—38c. to 42c. per lb.
NUTMEGS—20c. to 21c.
ORANGES—\$1.75 to \$3.00.
PIMENTO—5½c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 7.52c; Muscovados, 89°, 6.66c.; Molasses, 89°, 6.50c, all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., August 24, 1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.50 to \$13.00.
COCO-NUT OIL—\$1.25 per Imperial gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—No quotations.
DHAL—No quotations.
ONIONS—\$7.00 per 100 lb.
PEAS, SPLIT—\$11.00 to \$12.00 per bag.
POTATOES—English, \$5.00 per 100 lb.
RICE—Yellow, \$10.00 to \$10.75; White, \$7.00 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., September 18, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$8.25 to \$9.00.
RICE—Ballam, \$10.00 to \$10.80 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$6.00 to \$6.50.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND- BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



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Training in Plant Pathology.

AN address with the above title, delivered by Mr. J. Ramsbottom, of the Botanical Department of the British Museum, at a meeting of the British Mycological Society, is published in the *Transactions* of that body for the year 1916. The subject has a special interest for those tropical colonies which depend on the British universities for the supply of the men who function as investigators of plant disease.

While, characteristically, there has not been in the United Kingdom any special service for plant pathology worth mentioning, there exist plenty of facilities for

a many-sided, if unorganized attack on any problem of the kind which arises. Museum and University Departments, laboratories and libraries are all at hand. The position is very different in the tropics. There, the individual investigator is removed from opportunities of supplementing his education in the scientific aspects of his subject. For even the simplest form of contact, that which is made through reference libraries and current literature, his means are at best inadequate. From such circumstances arises the necessity for an initial training which goes further than the provision of a general groundwork of botanical science.

Mr. Ramsbottom points out that the practice has been to appoint students direct to pathological posts after a training in botany pure and simple, and one in which the specialized studies of the later part of the course have usually had little relevance to the work of investigating plant diseases.

While it may be claimed that the type of training indicated has not, in recent years, been quite general, and that it never prevented, though undoubtedly it delayed, the production of reasonably good results, there can be little argument as to the advisability of providing a special training in this subject. One does not take a student from a course in pure zoology and set him to practise as a veterinarian.

It then becomes necessary to decide as to the essential elements of such a training, and first of all to gain a proper conception of the work which will present itself when a post is taken up. It is in this connexion that the experience of agricultural departments, to which, in practice, the plant pathologist is attached, may afford useful evidence.

In the first place, although the term mycologist is still generally used in the British Empire, the work is not, in any preponderating sense, mycology. Mr. Ramsbottom adopts the wider American designation plant pathologist, and correspondingly recognizes the necessity of a knowledge of the general principles and practices of agriculture and horticulture, of soils and their properties, and of manures and their effects. His slight hesitation in including also the principles and practices of forestry would disappear were he aware how little the ordinary cacao or lime plantation, to say nothing of the case of rubber, differs in the problems of its formation and management from an artificially established forest.

The tendency of the mycologist, in earlier days when he really was a mycologist, was to give first attention to the identification of the fungi he found in the lesions of a disease, and secondary attention to the nature of the lesions themselves. Then he might (surprisingly often he did not) give consideration to the position of the host itself in regard to its general environment. The grower, who was properly more concerned about the plant than the fungus, had a corresponding tendency to regard him as a harmless enthusiast without relation to practical matters.

Though the attitude thus indicated may be considered to be, as a whole, long out of date, its influence still narrows the conception of the qualifications required.

That there is a change taking place in the scope of the work, the recognition of the need for a wider title signifies. And the difference is more than that arising from the importance now conceded to bacterial diseases and to functional disturbances of unknown origin. The plant pathologist, as he is being shaped by his association with agriculture, is adding to the function of determining the nature of individual diseases, the consideration of the general circumstances under which they develop. Watching the crop as a medical officer of health watches the population of his district, he recognizes that certain conditions render it liable to corresponding types of disease, in which the preponderance of this or that particular organism, with its specific affection, is more or less a matter of chance.

Under such circumstances, the study of all the factors which affect the condition of the crop becomes for the plant pathologist, as for the planter, a matter of first importance. On this ground he establishes contact with those exponents of ecology who, starting from the base of physiology, are rapidly extending the

intensive study of the biology of crop plants in the field.

To see this movement in operation we have to look, for the most part, to recent work in the United States of America; but there are British examples of what we mean in the studies of Dr. W. L. Balls on the Egyptian cotton plant, and that of Mr. A. Howard on certain Indian crops. It is perhaps some justification of the course of our argument that Mr. Howard began as a mycologist, and Dr. Balls as a cryptogamic botanist—which is hardly more than mycologist written large. It would not be difficult to find examples enough to argue from that these cases represent a general tendency.

It would appear that there is a definite need for what we may more or less suitably term the agricultural ecologist. He could not be called pathologist, for he would be more concerned with healthy plants than diseased ones. He would consider the plant and all its functions in relation to the natural and the artificial factors of its environment, and analyse the effect of these upon production. By so doing he would set free the economic botanist to his economics, the plant breeder to his genetics, and, what is more relevant to the present argument, enable the pathologist to return to the intensive study of his diseases.

It remains to be seen how far the loss of time, the waste of energy, and the tendency to empiricism involved in the present British system, in which the newly appointed botanist is in many cases left to be developed by contact with the duties of his position, can be diminished by preliminary training. We have reached the conclusion that there is a necessity, compared with which that for purely pathological investigations is sectional and subordinate, for the biological study of crops as they grow; and that the results of the investigations of diseases as such depend for their useful application upon knowledge of field conditions which such biological studies would supply.

Coming to the consideration of University courses in relation to the requirements stated, we would venture the opinion that what is needed, in addition to the provision of post-graduate courses in certain special subjects, is the bringing of the subjects of the general botany course into more definite combination.

The general aim of a botanical education, as we conceive it, should be to envisage, as far as possible, the living plant, as determined by its ancestry, in all its relationships with its environment. That the current allocation of time and interest to the various

sections of the subject is determined by such a general concept nobody, probably, would attempt to maintain. The reply would be that no such combination is yet possible, and that it is more fruitful to pursue single lines of research, unrelated as they may at present appear.

But a working synthesis of botanical knowledge, persistently defective as it must be, is no less persistently necessary. The ability to make it and to apply it to the crops with which he is concerned is the most valuable equipment with which the agricultural botanist, in whatever direction he is to develop, can be supplied.

Given the ecologist, as thus conceived, at work, it would still be as necessary as ever that individual diseases should be submitted to detailed study. Released from the present necessity of facing the formidable list of somewhat extraneous knowledge which we have quoted from Mr. Ramsbottom, the pathologist could become in fact a specialist, and would need, after completing the botany course, a specialist's education. This would include a working knowledge of the groups of fungi and bacteria, of the technique of cultures and infection experiments, of special anatomy and physiology, and, what is perhaps most difficult to obtain from current provisions, a knowledge of the history and present position of his subject.

It is, one hopes, inevitable that sooner or later there will be research stations in the British tropics maintaining some kind of connexion with the home universities. Meanwhile, their defect could be fairly adequately supplied by arrangements which might easily be made for attaching students for a year's experience to one or another of the existing Agricultural Departments.

THE GOVERNMENT GRANARY IN ST. VINCENT.

A short report on the first year's working of the St. Vincent Government Granary has lately been forwarded to the Commissioner of Agriculture by the Agricultural Superintendent of St. Vincent.

The accounts for the co-operative purchase of Indian corn at the granary have been closed for the crop, and the resulting bonus declared and paid.

It appears that 150 persons supplied corn on the profit-sharing basis, receiving on account 3s. 4d. per 100 lb. for corn on the cob, or $\frac{1}{2}$ d. per lb. for shelled grain; the first payments amounted to £170 9s. 11d. To this must be added £89 3s. 9d. necessary working expenses, making a total outlay of £269 13s. 8d. The amount realized by the sale of meal and corn was £523 17s. 2d. showing a profit of £264 3s. 6d. A bonus of 120 per cent., calculated on the price paid on account, was paid to the growers, leaving some £60 apparently as the granary's share of the profits. The meal

was sold from the granary at 15s. 7 $\frac{1}{2}$ d. per 100 lb. and in small lots at 2d. per lb. The total estimated quantity of corn dealt with for the crop was 128,589 lb. of undried grain, which equals 2,296 bushels or 1,148 bags. Of this amount 78,988 lb. were dealt with on the profit-sharing basis, the remainder having been treated for outside growers, who were charged 1d. per cwt. for shelling, 4d. per cwt. for kiln-drying, and 1d. per 7 lb for grinding. The Superintendent however writes that he considers the charges for shelling and drying too low, and that these will probably have to be raised in future.

This first year's working of the granary thus shows excellent results. Practically all the corn was converted into meal, which was sold at a profit at a low price for local consumption. Considering the much higher price of imported corn meal, this must have been a great boon to the colony at this time.

The following estimates obtained from results in working will be of value to other such granaries: the average ratio of corn to cob by weight was from 75 to 77 per cent., the loss of weight of corn in kiln-drying was from 6.5 to 7 per cent.

CULTIVATION OF POTATOES IN THE WEST INDIES.

Potatoes, not sweet potatoes, but the tubers that are generally known in the West Indies as English or Irish potatoes, are principally a crop of temperate latitudes. They can be grown profitably, however, in most of these islands.

The *Journal of the Jamaica Agricultural Society*, July 1917, says that the time for beginning the planting of potatoes is late in October, but preferably early in November, as soon as risk of heavy rains is over. This applies to the lowlands of Jamaica, and presumably is sound advice for the lowlands of the smaller islands. Plantings may continue to be made until March, though the last month is rather late, the potatoes being apt to run to bush, and the tubers to sprout in the soil before being fit to be raised.

The time to prepare the land for November planting is in July and August. The soil should be prepared with plough or hoe or fork, and trenched deeply. Then later, when the rough clods have been weathered, it is easier to refine it. If manure is available it should be spread before this refining, but if manure is not plentiful, it is better to add it to the furrows or drills at planting time. When the land is thoroughly prepared it should be furrowed or drilled not less than 6 inches deep, and 2 $\frac{1}{2}$ feet apart. Manure should be added at the bottom of the furrows or drills.

Potatoes should be cut into sets, which should each be not less than 1 $\frac{1}{2}$ oz. in weight. Small potatoes may be planted whole. In cold climates it is the practice to ridge up high to get all the heat into the soil that can be got. In this climate, where the soil is hot enough, and sometimes very dry, the roots want to be kept cool and moist. Therefore cultivation, as nearly level as possible is best. When the plants are 3 to 4 inches high, fork lightly between the rows so as not to injure the rootlets, drawing a little earth up to the potatoes. Later on, when the plants are 7 or 8 inches high, the soil between the rows should be forked 2 or 3 inches deep, and again slightly drawn up to the plants. The plants will then appear to be growing on a slight but not high bank. The tubers under favourable weather conditions ought to be fit to lift in ten or twelve weeks after planting, but wet weather may probably delay reaping some little time longer. When potatoes are fit to be reaped the stalks of the plants should have dried up.

OBSERVATIONS ON THE COTTON STAINER IN ST. VINCENT.

In the latest number of the *West Indian Bulletin* (Vol. XVI, No. 3) is to be found a paper by Mr. W. N. Sands, Agricultural Superintendent, St. Vincent, giving an account of the observations recently carried out by him in connexion with the life-history, habits, food-plants, and control of the cotton stainer in that island. The following summary will show that Mr. Sands has made some observations of considerable interest and value, and that under his direction an energetic campaign has been carried out against the wild food-plants of this pest.

The association of the cotton stainer (*Dysdercus delauneyi*, Leth.) with certain destructive internal boll diseases which have caused large losses of seed-cotton within recent years in St. Vincent, has made it imperative to carry out some control measures against this pest, and it was thought advisable to work out the life-history of the species.

A short description of this insect is given, and it is stated that this species occurs throughout the coastal district of St. Vincent, and is found in other West Indian islands, its range extending from Montserrat to Grenada.

The life-history was worked out in the laboratory in breeding cages consisting of hurricane lamp-chimneys inverted in lids of butter tins. River sand to a depth of 2 inches was placed in the bottom of each chimney, food was supplied as needed, and the top kept covered with gauze. Records were made daily between 7 a.m. and 10 p.m. from December 1916 to April 15, 1917.

Experiments were made in the cages to find out where the eggs are laid by supplying the insects with (a) seed-cotton, (b) old cracked cotton bolls, (c) freshly opened bolls, (d) unopened cotton bolls, but no eggs were laid anywhere but in the sand at the bottom of the chimneys. The eggs were found to be laid in pits, and covered with sand by the female. The operation of egg-laying was witnessed several times in the laboratory, and the results gave a clue to the place and manner of oviposition in the field. It was found that eggs are deposited in masses in the ground, and covered over, but the act of oviposition was not observed in the field, since it no doubt takes place at night, and no observations on this point were made after 7 p.m. Frequent search for eggs on all parts of the cotton plant, silk-cotton, and John Bull trees over a considerable period has been without result.

The eggs are smooth, ovoid, and creamy white with a pearly lustre. They are slightly sticky when first laid, but separate freely when dry. They change in colour before hatching, at first becoming tinged with yellow, and by the seventh day they are deep orange. Eggs kept dry in glass tubes hatch in seven days; those laid in moist, sandy soil take seven and a half to nine days to hatch. The eggs appear to be nearly always fertile.

After hatching, the stainer bug moults five times before reaching adult stage in from twenty-seven to thirty days. The sexes mate within three or four days after maturing, and eggs are laid for a new generation in about six to eight days later. Tables are given showing that the complete life-cycle occupies from forty-seven to forty-nine days.

Before a moult the insects collect together in masses sometimes on any plant that provides shelter, and this habit partly accounts for the erroneous ideas about the feeding habits of the stainers.

Observations show that dark greenish-yellow excrement was not voided until maturity was reached. In other stages the excrement was colourless or slightly tinged only. This is an important point, as showing that the younger stages, or

nymphs, cannot damage seed-cotton by staining, even if present in large numbers.

Another point of considerable interest is that young nymphs are apparently unable to feed on unopened fruits of silk-cotton, John Bull or cultivated cotton, and experiments made in the laboratory in this connexion tend to show that in the immature stages the insect cannot pierce and feed through the carpels. Further experiments are to be made on this point before any definite conclusions can be drawn.

The egg-laying habits of the female are described in detail, showing how she digs a small pit, places her eggs and covers them over so as to make them as inconspicuous as possible. Therefore they are difficult to find in the field.

Up to the present the cotton stainer has not been found to breed on any other species of food-plants but those belonging to the Malvaceae, and the related Sterculiaceae. A list of food plants is given, the most important being the silk-cotton (*Eriodendron anfractuosum*), the 'John Bull' or mahoe (*Thespesia populnea*), and the 'Mahoe cochon' or 'Stave wood' (*Sterculia caribaea*). In certain districts in February, March and April when food is scarce and the weather is dry, cotton stainers may be observed feeding on the flowers of the following plants: guava, cacao, banana, plantain, *Cycas circinalis*, *Euphorbia canariensis*, and galba, and the secretions of scale insects. They have not been observed to breed on such plants. Observations in the field show that periodical flights of cotton stainers in considerable numbers take place from one food-plant to another.

In St. Vincent it is required by law that all cotton plants, wild and cultivated, be pulled up and burnt by April 30 in each year. Most of the cultivated plants are destroyed by the end of February, at the completion of the crop. Planting of the new crop begins in May with the rains so that there is an interval during which the stainers must have food other than cotton to carry them over from one season to another.

Investigations made throughout the island showed that the chief nurse trees are the silk-cotton and the John Bull. An account of these trees in relation to the cotton stainer was given by Mr. Sands in the *Agricultural News*, Vol. XV, Nos. 369, 370, and 373 (1916) under the title 'Native food-plants and feeding habits of the cotton stainer in St. Vincent.'

The case against the silk-cotton tree may be summed up as follows: 'It is a tree which provides, when it fruits, a large amount of food for the cotton stainer, and so enables the insect to feed and breed extensively, and tide over a season when it is so important that its numbers should be reduced to a minimum for the protection of the annual cotton crop, planted in May, June, and July: therefore it should be destroyed.'

An Ordinance was passed to provide for the destruction of these native food-plants, and the eradication was carried out between August 1916 and April 1917 by the Agricultural Department, at Government expense. During the period 1,542 silk-cotton trees, 11,570 John Bull trees, and several thousand seedlings were destroyed at a total cost of £300. A copy of the Ordinance is included in the paper.

Further suggestions made by Mr. Sands for controlling the cotton stainer are:—

- (a) A close season for cotton from February to May.
- (b) The trapping of the pest by means of cotton seed, seed-cotton, or cotton-seed meal just before the cotton starts to flower.
- (c) The collection of cotton stainers in the field.

In regard to (a) it is thought that if a close season for Sea Island cotton from February to May is instituted, cotton planted in the latter month would not flower before July,

and there would be little food for the pest from February to July.

In connexion with (b) it may be mentioned that the most satisfactory method of killing the stainers which collect on the cotton seed traps is the use of a gasoline torch. After a few minutes' application most of the insects were killed, and it was found that burning does not destroy the effectiveness of the cotton seed as a trap, as kerosene oil does. Cotton seed was found to be a more effective trap than either silk-cotton pods or cotton-seed meal.

The natural enemies of the stainer include birds, ants, and a species of mite. The 'Pipiri' or 'Hawk-beater' (*Tyrannus rostratus*) eats a large number of stainers, as examinations of stomach contents showed. The blackbird (*Crotophaga ani*) and domestic fowls consume a limited number.

The common small black stinging ant (*Solenopsis geminata*), and the hunting 'tac-tac' ant (*Odontomachus haematodes*) both carried off the eggs readily, while the small red stinging ant (undetermined) frequently tried to do so, but failed. The crazy ant or 'Wild Irishman' (*Prenolepis longicornis*) was strongly repelled by the eggs. No egg parasite has been observed.

ADAPTATION AND THE PHYSICAL BASIS OF BIOLOGICAL CHARACTERS.

In the course of a series of four Croonian Lectures delivered at the Royal College of Physicians, London, in June last, Professor J. G. Adami put forward some new biological conceptions of much importance. In the first place he raised the question whether variation is inherent, proceeding from within, or whether it is acquired, proceeding from without. He charged biologists with largely neglecting this aspect of the inquiry into methods of evolution, and with directing attention almost exclusively to the secondary problem of the transmission of acquired properties to the offspring. After discussing the attitude of workers such as Herbert Spencer, Weismann, and Bateson towards these problems, he stated that valuable and fascinating as are the studies for the establishment and amplification of Mendel's law, that law deals only with the combinations and permutations of positive and negative unit properties possessed by the species; it establishes only the extent of variation possible within the species. The study of immunity, and the problems of pathogenic bacteriology lead to the conclusion that bacteria manifest direct adaptation, i.e., specific modification in response to specific alteration in environment, that is to say, change of environment gives rise to new species. He points out that there is, for example, abundant experimental evidence of adaptation of bacteria to new food-stuffs, to foreign sugars, glucosides, fats, etc. The bacteria taking on these new powers must be regarded, not as mutants, but as new species arising from the influence of a particular environment. In a similar way, the acquirement of virulence in the case of a bacillus, derived by Thiele and Embleton from the harmless saprophytic form *B. mycoides*, must be regarded as permanent change arising from the effect of environment, that is, direct adaptation.

The creation of immunity towards specific diseases on the part of the higher animals arises from adaptive changes produced in certain body cells, whereby they have acquired new habits under the influence of environmental changes; as the result of these changes, the cells are able either to destroy invading organisms or to inhibit their growth. These changes

result in the establishment of a regular habit on the part of the affected cells, the cells are impressed with new properties. Immunization is direct adaptation.

Of very great interest to general biologists is the lecturer's suggestion as to the mechanism by means of which individual properties and characteristics are carried and transmitted. Darwin discussed the possibility of these properties being carried by specific atomies diffused through the body structure, the pangenesis hypothesis, but he abandoned this as untenable. Other workers, such as Weismann, have postulated the existence of specific carriers of properties, and have suggested the existence of specific ids, idants, and determinants; while Mendelian students are disposed to the idea that the chromosomes of the nucleus are the specific carriers of individual characters, but they find difficulty in conceiving how such limited bodies can carry the multiplicity of characters involved in every organism.

Professor Adami suggests that these difficulties disappear if we regard the protoplasmic contents of the germ cells as being the agencies involved in this work of transmission: he points out that there are many forms of protoplasm, and that the molecules even of the simplest types are of a marvellous degree of complexity, containing from 700 carbon atoms in the molecule, in the case of the relatively simple haemoglobin, to many times this number in the more complex forms.

It is well known that in the case of complex carbon compounds, marked change of properties results from modification in the manner in which the atomic grouping takes place. Even in the case of the simple sugars of the hexose group containing but six carbon atoms, modification in the manner of atomic grouping gives rise to sixteen different forms of sugars exhibiting different properties. There is little difficulty, therefore, in conceiving that molecules containing from 700 to 1,000 carbon atoms admit of an immense number of possible groupings, and, consequently, of exhibiting an immense number of characters or properties, which properties may exhibit themselves in the structure and function of the organisms in which the various protoplasms exist.

If we imagine that the various characteristics exhibited by different organisms are dependent on the nature and structure of their constituent protoplasms, there is no difficulty in thinking that the possible forms and combinations are numerous enough to carry and transmit all the individual characters of various organisms.

THE PRICE OF WHEAT AND FLOUR.

The American Consul at Barbados has communicated the following to this Department as the official order of the President of the United States:—

'Section 11 of the Food Act provides, among other things, for the purchase and sale of wheat and flour by the Government, and appropriates money for the purpose. The purchase of wheat and flour for our allies, and to a considerable degree for neutral countries also, has been placed under the control of the Food Administration. I have appointed a Committee to determine a fair price to be paid in Government purchases. The price now recommended by that Committee—\$2.20 per bushel at Chicago for the basic grade—will be rigidly adhered to by the Food Administration.'



JAMAICA: REPORT ON THE DEPARTMENT OF AGRICULTURE, 1916-17.

The part of this report which deals with insect pests has been reviewed already in the last two issues of the *Agricultural News*. The present article will deal with other matters of interest brought forward in other portions of the Jamaica Report.

The chief feature affecting the agricultural interests of the colony during the period reported on was the hurricane in August 1916. This practically destroyed the banana crop, as well as causing considerable damage to coco-nuts, canes, and cacao. It will be remembered that a similar disaster befell the banana crop in 1915. These two successive blows to Jamaica's chief industry have occasioned serious losses and hardships to a large section of the community. On the other hand, owing to war conditions, other products have brought improved prices, so that the total value of exports for the year showed an increase of £600,000 over that of the previous year.

The largest crop of sugar since 1884 was produced this year—over 28,000 tons, valued at over £500,000—which, together with some 18,000 puncheons of rum, valued at £350,000, raised the value of the products of the sugar industry to more than five times that recorded for the year before the war.

Mr. Cousins makes misleading remarks concerning the efficiency of Moreland sugar factory, stating that a return of 1 ton of sugar has been obtained from $8\frac{2}{3}$ tons of cane. This figure may possibly have been obtained over a very limited period; the average amount of cane taken at this factory to make 1 ton of sugar during last season was 10 tons: a good modern factory should have taken an average of $8\frac{1}{2}$ tons, with canes of the quality dealt with at Moreland: these figures more accurately measure the factory's efficiency. The owners of this factory probably fail to share Mr. Cousin's self-complacency. It should be unnecessary to point out that the quantity of cane taken to make a ton of sugar is a very imperfect indication of factory efficiency; the real criterion is the amount of sucrose in the cane. In this connexion reference may be made to the *West Indian Bulletin* Vol. XVI, p. 102; and the *Agricultural News*, Vol. XVI, p. 11.

The rehabilitation of the sugar industry in Jamaica must produce a beneficial influence on the agricultural and commercial prosperity of the island, but although the banana industry has met with such misfortunes for the present, it will doubtless still long continue to be one of the island's chief sources of wealth, even though the export of bananas this year fell to one-fifth of the normal.

As we go to press information is recorded of another disastrous hurricane striking Jamaica on September 24; full particulars of the damage done are not yet to hand.

Fortunately, a reduction in the number of plants affected by the Panama disease of bananas is reported. Measures are being taken to control the attacks of the banana borer which is causing some anxiety.

Another source of revenue has proved very profitable, for a time at least, that is logwood; a total value of £800,000 having been credited to logwood products for the year. Large quantities of logwood extract are being made and exported.

Although the hurricane of 1916 did some damage to coco-nut plantations, the export of coco-nuts for the year maintained the same high level as that of the previous year, viz., 27,000,000 nuts, with an improvement in value of 75 per cent. The world's market for coco-nuts appears to be widening, so that the future prospects of that industry are bright.

The exports of coffee show a small increase over those of 1915 in quantity, and in value an increase of £25,000. Unfortunately, owing to the recent embargo on importation of coffee into the United Kingdom, the growers of the well-known Blue Mountain variety have been seriously inconvenienced by being debarred from their chief market.

With regard to cacao, owing to damage done by the hurricane to the plantations, the export fell somewhat in quantity, but, as prices were good, the value of the year's export was put as £167,000.

Another promising agricultural interest in Jamaica is sisal cultivation. Some of the dry lands in the south of the island seem admirably adapted to this purpose. In 1915 about 45 acres were planted in sisal and in henequen at Lititz, an experiment station in the dry district. The plants have grown satisfactorily, but it became evident that the original spacing—12 feet \times 6 feet—was unnecessarily wide. The present plan is to plant 7 feet \times 6 feet thus getting many more plants to the acre, and much reducing the cost of cleaning. Both sisal and henequen are doing well at Lititz, though sisal seems to be the more suitable for the particular situation. There are plants now available for establishing 300 acres, and it is hoped to double this stock during the coming year. It appears very probable that a profitable industry in sisal fibre may soon be established.

The work of the Government Stock Farm at Hope presents many points of interest. In the first place it is noticed that on the farm, as is generally the custom on stock-farms in Jamaica, the pods of the guango (*Pithecolobium Saman*), known in other islands as the Jamaica Shade Tree or Saman, are largely employed as stock food. No less than 40 tons of these pods were in storage at Hope for use in the coming year. Stock farmers in the other West Indian islands might well take example in this matter from the Jamaicans, who make use of the pods or fruit of several other local trees to furnish part of the rations of their stock. They also use the leaves and twigs of several species of trees as green forage, especially in times of drought.

The results of the first stages in the evolution of the cross between the Zebu and the Jersey as a tropical milch cow are now in evidence. It appears that the Zebu-Jersey is superior to the pure Jersey in size, vigour, hardiness, and productive capacity; the cows of this strain in the Station herd are proving first class dairy stock.

The benefit to the stock arising from effective control of ticks, which is secured by the regular use of a dipping tank, in which the whole herd is dipped, on an average, every three weeks, has been very marked, although it cannot be said that ticks have been eradicated. It is computed that a useful tank, capable of dealing with from 200 to 400 head of cattle, can be erected in Jamaica for about £35, and that the cost of the materials used in preparing the dip—arsenite of soda and paranaph—works out to 3d. per head of stock per annum.

The report of the working of the Farm School at Hope shows that the authorities are to be congratulated on good

results. The students receive instruction in the following subjects: Principles of Agriculture, Dairying, Live Stock Management, Veterinary Science, Elementary Botany, Chemistry and Physics, Apiculture, Arithmetic, Book-keeping and Surveying. Besides this class work the students take a share in the practical work of the Stock Farm, while the crops of the Experiment Station afford good opportunity for practical agricultural work, which is taken advantage of to the full.

All the seven students who graduated with certificates in December 1916 are at present working either on their fathers' properties, or as bookkeepers on sugar estates and plantations. There is an increasing demand from planters for students who have completed their three years' course, to fill positions on plantations.

With regard to the work on ornamental plants and flowers in the various gardens, we note points that may be useful to other gardeners in these islands. The first is the advice as to treatment of *Hippeastrum* bulbs, especially the beautiful hybrids, many of which have been produced locally. It is found advisable to lift the bulbs early in November, dry them off for six or eight weeks, and then replant. The second point is that cuttings of the cherry-red *Bougainvillea*, which is locally known in Jamaica as Ruby, will flower freely when not more than 1 foot in height, thus making it very suitable for pot culture.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. In his report for the month of August, Mr. J. C. Moore, Superintendent of Agriculture, states that in the Botanic Gardens work of a routine nature was maintained as well as irregularity and shortage of labour permitted. Plant distribution included the following: limes 6,923, coco-nuts 12, budded oranges 3, timber 48, ornamental 40, palm seeds 17,550 horse beans 58 lb., other economic 400.

The condition of the cacao crop is said to be good; much crop was not expected before November or December. Thrips was scarce generally; there were prospects of a mild attack this year. The condition of the lime crop was normal; planting continued. A similar report is made as regards the nutmeg and sugar-cane crops.

The rainfall recorded during the month at Richmond Hill was 10.58 inches. Bright hot weather with light showers prevailed since the 23rd instant.

ST. VINCENT Mr. W. N. Sands the Agricultural Superintendent, writes to say that during the month of August work in the Experiment Stations included the laying out and planting of cotton distance trial plots, applying manures and planting cotton manurial experiment plots, sowing Sea Island cotton selections and many varieties of peas and beans, and collecting and destroying wandering cotton stainers. Selected cotton seed distributed from May 1 to August 31 from the ginnery amounted to 11,359 lb. In the Botanic gardens the operations were of a routine nature.

The staple crops generally made good progress under the influence of excellent weather. The Cotton Inspector paid further visits to the estates named in last month's report and also to Argyle and Fitzhughes to search for cotton stainers. He reported that he was unable to find any insects. Two cadets, ex-pupils of the Grammar School, were admitted for training in agriculture under the Department.

DOMINICA. Mr. Joseph Jones, Agricultural Superintendent, in a report recently received at this Office states

that, during the latter end of the past week heavy rains with fairly high winds were experienced in Dominica. On the night of September 20, 5.74 inches of rain fell at the Botanic Gardens, and the total rainfall during the 19th, 20th, and 21st instant was 8.44 inches. Considerable damage has resulted to roads and bridges, especially in the south of the island. Very considerable sums will be needed to repair the damage. Some estates have suffered considerably from floods and landslides; one estate reports the loss of 1,000 lime and 400 cacao trees. Rose's factory at Grandbay was swept away and 40 puncheons of raw lime juice were lost.

ANTIGUA. According to the report received from Mr. T. Jackson, work in the Experiment Stations during the month of August was of an ordinary routine nature. Plant distribution comprised the following: bay plants 312, decorative 17, cotton seed 307 lb., sweet potato cuttings 500. In addition, some 20,000 plants of sisal were imported and distributed to date. Besides ordinary routine work in the Botanic Gardens, a new roof was put on the store-room of the Botanic Station, the work being executed by the Public Works Department.

The young cotton crop, on the whole, was promising; in some parts of the island the reaping of cotton had commenced. The young cane crop was in fair condition. Gunthorpes and Bendals central factories completed their season's work during the month. The former made 11,705 tons, and the latter 2,100 tons of sugar. Some anxiety, says the Agricultural Superintendent, is felt among planters as to the non-arrival of onion seed for the coming crop.

The work of agricultural instruction in the English Harbour district was being continued. It is believed that now that a definite beginning has been made, a number of plots will be taken up and worked at Sawcolts.

The rainfall during the month was 3.74 inches; for the year to date, 24.64 inches.

NEVIS. Mr. W. I. Howell reports planting and reaping operations in connexion with the plots in the Experiment Stations during the month of August. The following plants, seeds, etc., were distributed during the month: Indian corn 392 lb., cotton seed 88 lb., black-eye peas 23 lb., Para peas 17 lb., shade trees 12, onion slips 400.

The Curator states, in regard to staple crops, that the young canes throughout the island were not making very rapid growth, and in many places the crop was suffering from want of rain. Cotton was very promising, and should the weather continue favourable the crop would be a very large one, with better yields per acre than for some years past. Reaping was in progress in some places, and good returns had been obtained. Cotton worms had done little or no damage to the crop; so far very few fields had been attacked. Provision crops continued to do well, but little planting had been done during the month. Sweet potatoes were being reaped.

The rainfall for the month was 4.02 inches; for the year to date, 26.72 inches.

TORTOLA. During the month of August, writes the Curator, Mr. W. C. Fishlock, agricultural work in the Experiment Stations was greatly delayed by the long drought. Operations consisted chiefly in weeding the various plots already planted, and preparing land for other crops. The following plants and seeds were distributed: potato cuttings 150, cabbage plants 12, coco-nut plants 2, cotton seed 98 lb. The condition of staple crops generally was poor; climatic conditions had been very unfavourable, and growth retarded. There was little or no progress to report in any direction. In regard to insect pests, it was noted that green fly was troublesome on cotton.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial treats of the training needful for plant pathologists in the future.

The articles on pages 308, 318, and 319 may be well read together: they all have reference to the connexion between cotton stainers and internal boll disease, and their influence on the yield of cotton in certain islands.

On page 309 there is given an outline of recent theories on the physical basis of biological characters.

Under Insect Notes, page 314, an article appears on the life-history of warble flies, a serious pest to cattle in Europe and North America.

'West Indian Bulletin', Vol. XVI, No. 3.

Number 3 of Volume XVI of the *West Indian Bulletin* has just been issued. It contains several papers of exceptional interest, based on original investigations. Questions relating to cotton are dealt with in the principal articles. The first paper by Mr. S. C. Harland, B.Sc., Assistant Agricultural Superintendent, St. Vincent, gives an account of manurial experiments with Sea Island cotton in St. Vincent, with some notes on factors affecting the yield. It is illustrated by careful diagrams. Mr. Harland also contributes a note on resistance to black scale in cotton, and a short paper on manurial experiments with arrowroot in St. Vincent. In the second paper Mr. W. Nowell, D.I.C., Mycologist on the staff of this Department, gives an account of his investigation with regard to internal disease of cotton bolls in the West Indies. The third paper, which is illustrated, is by Mr. W. N. Sands, F.L.S., Agricultural Superintendent, St. Vincent. Abstracts of these papers appear elsewhere in this issue. Short notes follow: the first, by Dr. H. A. Tempany, D.Sc., F.I.C., now Superintendent of Agriculture in Mauritius, in association with Mr. R. E. Kelsick, Acting Chemical Assistant, St. Kitts, explains a modified method for determining carbonates in soil; the second, also by Dr. Tempany, deals with the determination of non-fatty solids in milk from the specific gravity at tropical temperatures. The last paper describes the course taken by the hurricanes of 1916, with notes on hurricanes of 1912-15. This, by Richard Hanson Weightman, is reprinted from the *Monthly Weather Review*, U.S.A. Department of Agriculture Weather Bureau. The number is concluded by a hurricane cable code used in the West Indies by Agricultural Officers associated with the Imperial Department.

Agricultural Instruction in Antigua.

The officer of the Agricultural Department whose duty it is to visit the lands rented from the Government in the English Harbour District, for the purpose of giving instruction to the cultivators, reports that the young cotton crop presents a healthy appearance. The occurrence of leaf-blister mite is much less than last year; on only one of the holdings were the plants attacked to any extent. This is attributable probably to the fact that immediately adjoining this holding is a field of cotton plants left from last season, which are badly infected. It ought always to be borne in mind that injury to the growing cotton crop, both one's own and one's neighbour's, is sure to result if diseased plants from the last year are left undestroyed. It is essential that old cotton should be destroyed efficiently at the close of the reaping season. If necessary, legislative powers should be invoked to effect this.

The corn crop in the same district is being reaped, and is giving large returns. There has been a ready local sale of the product at a good price, and it seems likely that the whole crop will be disposed of in a similar way.

More land in the district is being taken up by peasant cultivators, who intend growing cotton principally.

Combining General Agriculture with Sugar Growing in Queensland.

According to the London correspondent of the *North Queensland Register*, the grower of sugar in Queensland who combines the cultivation of other crops with that of cane usually makes more out of agriculture than his neighbour who depends solely on the one crop. All the sugar-growing areas of Queensland are admirably adapted for the successful cultivation of quite a number of crops. For instance, maize, potatoes, root crops, and fruits of many kinds do exceptionally well, and give very profitable returns. Then again, the tropical portions of the State are also suitable for the growing of rubber, coffee, rice, tea, cotton, vanilla, etc., as has been demonstrated for a number of years past. There are also big possibilities in dairying, and many cane-growers to-day are supplementing their receipts from the cultivation of cane by the regular monthly cheques received for the cream sent to the local butter factories.

The Conjoint Board of Scientific Societies.

The fourth meeting of the Conjoint Board of Scientific Societies was held at the Royal Society on June 13, Sir Joseph J. Thomson, O.M., President of the Royal Society in the Chair, to receive the report of the Executive Committee, on the work of the previous six months.

As the Report indicates, a number of important questions of scientific and industrial importance have occupied the attention of the Board.

Among these were matters dealt with by an Agricultural Sub-Committee, with the Earl of Portsmouth as Chairman, which reported that it is at present devoting itself mainly to engineering questions. It is engaged in collecting information with regard to the transport of raw materials to farms and agricultural products from them; to the power required for this purpose, and for seasonal operations on the land, with a view to comparing the relative advantages and costs of steam or internal combustion engines and electrically operated machines. It is dealing also with the possibility of co-operation in repairs and skilled labour, and is considering the various types of tractor most suitable to large and chiefly arable farms, and to moderate sized mixed farms, having regard to the different local circumstances and requirements.

The Quality of Canes Damaged by Fire.

The following is taken from an article by Dr. Ulrich, the Entomologist of the Agricultural Board, Trinidad, which appears in the *Louisiana Planter*, August 11, 1917.

'The factory manager has often to deal with canes from burnt fields. Not only that cane fields get accidentally or maliciously burnt, but the firing of fields under old or neglected ratoons is often resorted to in order to facilitate the task of the cane cutters.

Given fairly dry weather, the chemical change in the juice from burnt canes is less than might be

anticipated. The following statement shows that during five days there was hardly any perceptible loss in the sucrose content of the juice. Afterwards deterioration set in as shown by a rise of the glucose content, and a declining purity. While the normal cane juice from this district had a purity of 84 to 87 per cent. with 1.3 to 1.6 per cent. glucose, the juice on the tenth day after the fire contained 2.94 per cent. glucose with a purity of 75.9. The sucrose content, however, was still very high, viz., 15.69 or 1.70 lb. sucrose per imperial gallon.'

Molasses as a Manure

The *Archief* of the Syndicate of Sugar Manufacturers in the Dutch East Indies, dated January 1917, gives the results of certain bacteriological and biochemical soil studies by F. C. Gerretsen, in the course of which observations were made as to the effect of molasses used as a manure. In some soils there was a notable increase in nitrifying bacteria and of combined nitrogen; in others, although no such increase could be detected, there was still a favourable influence exerted on the crop. This is attributed to the formation of humus from the decomposition products of the molasses by fungi and bacteria, with the result that the water-retaining power of light soils is very considerably augmented.

New Industries in the Caicos Islands.

The report of an official visit paid by Mr. H. H. Hutchings, Secretary of the Turks Islands Agricultural and Industrial Society, to the Caicos Islands, published in the *Gazette*, Turks and Caicos Islands, August 25, 1917, furnishes evidence that considerable interest is being awakened in that group in various new and useful directions, which should eventually serve to improve the condition of those small islands.

In the first place six rope-making machines have been placed at various centres, and public demonstrations of rope making have been given, so that the principles of the manufacture should be well understood. These demonstrations were watched with interest by appreciative audiences. The machines will doubtless be of great service, for sisal fibre is locally produced, new plantings of sisal being of considerable extent. Remunerative prices are being obtained for hand-cleaned fibre, in which industry there appears great activity in all the islands.

There is also expressed a lively interest in cotton growing among the peasant proprietors, and the prospects in that direction are promising.

Shark skin, tanned locally, seems to have some future possibilities. The tanning material used is the bark of the mangrove tree, and the process is said to be short and simple.

The early crop of corn in all the islands is reported to have been the best for many years. In view of the greatly increased price of imported foodstuffs, the islanders have been advised to store as much corn as possible for local use.

INSECT NOTES.

WARBLE FLIES.

Cattle in Europe and North America are subject to the attacks of warble fly maggots or 'bots', which cause swellings or 'warbles' to form under the skin of the back. Subsequently the hide in this region becomes perforated with holes through which the thick fleshy maggots emerge, dropping to the ground to pupate, and a few weeks later appearing as adult flies. The two common species of warble flies attacking cattle are *Hypoderma lineata* and *H. bovis*; both species are common in Europe, while *H. lineata* is the common species in the United States and Canada, although the other occurs. The life-history of a warble fly (the two species may be treated as one) presents several features of interest, for, although the development of the later stages of this fly has long been known, there are certain points in its life which for many years have been a puzzle to workers in Europe and North America. It is only quite recently that the mystery has been cleared, and the complete life-history of this pest established with some degree of certainty.

An interesting account has recently been given by Mr. Warburton* of the way in which our present knowledge of the life-history of the warble fly has been reached. In preparing the following short sketch the above report has been drawn on, and the more recent literature on the subject of warble flies has been consulted, as summarized in the *Experiment Station Record*, Washington, and in the *Review of Applied Entomology*, London, since in most cases the original reports and articles have not been available.

About thirty-five years ago the late Miss Ormerod issued a popular leaflet on the warble fly after years of study on this pest in England. The main points of this leaflet, as given in the above report, are as follows:—

'Warble flies lay eggs in the backs of cattle during the summer. The grubs live in the hide and set up irritation on the products of which they live. In early spring the swellings on the back develop openings to the exterior into which the grub introduces its tail, which bears the breathing pores, and here it remains till it is "ripe", when it emerges and changes to a chrysalis, which presently gives rise to the fly. Therefore, there are two things to be done, namely to destroy as many grubs as possible before they escape, and, by preventive smears, to warn off the fly from laying its eggs on the animals' backs during the hot weather.' Miss Ormerod described the later stages of the warble fly accurately, but was mistaken about the egg-laying process. She was however able to modify her views before her death.

This simple and straightforward account was altogether upset a few years later by the discovery that the eggs are not laid in the hide, but are fastened to the animal's hairs. Moreover, the hairs to which eggs are attached are not in that part of the body where the warbles appear, but are almost as far away from it as possible, the favourite position for egg-laying being on the hairs of the legs, or of the flanks. And now comes the problem, how does an egg laid on a hair of the leg give rise to a warble on the back?

The details of the life-history as modified by this discovery were given by C. V. Riley in 1892 (*Insect Life*, Vol. IV, Nos. 9 and 10, 1892). With the discovery that the

eggs are not laid on the back but upon the legs and flanks, it was found that the young larvae first appear in the wall of the gullet, and later migrate to the back. How they reached the back from the gullet, wall was not then known, and it remained for recent investigators, as will be shown below, to trace out at least one definite route taken by larvae or maggots.

To account for the presence of the larvae in the gullet wall, it was quite reasonably suggested by Riley and others that the young maggots are taken on to the tongue by cattle when they lick themselves, and are passed to the gullet, into the wall of which they bore their way. Other theories were also put forward, among which was one that the tiny maggots on hatching bored their way through the skin, and gradually wandered in a general upward direction under the skin until they reached the back. The 'licking' theory, being the simpler, was generally accepted, and has appeared in accounts of the life-history of this pest for many years. In view of recent investigations, however, it would appear that this theory will have to be discarded.

THE LIFE-HISTORY OF A WARBLE FLY AS NOW KNOWN.

As mentioned above the two common species of warble flies are *Hypoderma lineata* and *H. bovis*. These are rather stout flies, somewhat larger than a blue bottle, with a large head, but with mouth parts unfitted either for 'biting' or sucking. These flies usually appear in sunny weather during the summer months, but have been noticed in British Columbia by Hadwen as early as April, and by Carpenter in Ireland as late as September. The eggs are attached to the hairs of cattle, chiefly on the hind limbs just below the heel joint or hock; they are rarely laid on the belly, flanks, or breast, and never, under natural conditions, on the back. The two species of *Hypoderma* differ in the egg-laying process; *H. bovis* attaches a single egg to a hair near its base, while *H. lineata* lays its eggs in rows of seven or more half way up the hair.

It has been suggested by Hadwen that the extreme uneasiness and often terror inspired in cattle by *H. bovis* is due to its persistence in attack, and to the fact that it is able to lay its eggs regardless of the movements of the animal, since it only lays one at a time.

The egg, in the case of *H. bovis* hatches about the fourth day and the minute maggot, about one-thirtieth of an inch long, penetrates the skin near the base of the hair, causing a watery exudation of serum. In the case of *H. lineata* it is suggested by Hadwen that, since a number of eggs are attached to the same hair the larvae may follow one another through the same opening, thus causing a larger opening and bigger flow of serum. These observations show definitely that the maggots enter the animal's body through the skin, and not through the mouth or gullet. They were first made by Carpenter and Hewitt in Ireland from 1910 to 1914, and confirmed by Hadwen in British Columbia in 1915.

After entering through the hide the maggots disappear for a time, only to reappear in the wall of the gullet, where they are to be found all through the autumn and winter. It is suggested by Warburton that the microscopic larvae may enter the blood stream, and be carried by it to the gullet but nothing definite is known as yet. The maggots disappear from the gullet in March, and from there until they reach the back they have been followed with more certainty. One definite route has been traced by Hadwen and Bruce, and an account is given in *Bulletin 22*, Department of Agriculture, Canada, 1916. This is summarized by Warburton as follows: 'According to this (*Bulletin 22*) the maggots

**Journal Royal Agricultural Society*, England, Vol. LXXVII, p. 227. Report of Zoologist for 1916.

leave the gullet near its junction with the paunch, and enter the connective tissue of the diaphragm, which they follow between the strands of muscle downwards and outwards till they reach the cartilage of the ribs. They then proceed along the posterior border of a rib—always in the connective tissue—and either go straight to the hide of the back in that region or find their way into the spinal canal, from which they can emerge again nearer the animal's tail.'

Having found their way to the back they puncture the skin, and complete their growth until they become 'ripe'. They then emerge from their warbles and pupate in the ground, emerging as flies in about five weeks, on the average.

TREATMENT FOR WARBLE FLY MAGGOTS.

It is now generally recognized, both in Europe and in North America, that the best control method against the warble fly is the systematic destruction of the mature maggots by squeezing them out of the warbles before they emerge of themselves and drop to the ground to pupate.

In some of the countries of Europe it has been recommended that the cattle be kept under shelter during the heat of the day when the flies are likely to be troublesome.

One of the old methods of control by the use of preventive smears on the back has died hard, in spite of the fact that it has long been known that the flies do not lay their eggs on the back.

A number of experiments were made by Carpenter from 1904 to try and find out whether preventive smears would be of any avail if applied to the legs and other parts of the body except the back. The results showed that such treatment is not effective, since the smeared cattle were about as badly affected with warble maggots as the untreated. Carpenter, Hewitt and others have also carried out numerous experiments with a large number of preparations, with the idea of trying to kill the maggots on the back of the animal by applying ointments of various kinds to the holes made by the maggots, but so far no satisfactory preparation has been discovered. Those applications that were most efficient in killing the larvae were at the same time injurious to the cattle.

Many of these experiments have also been tried in some of the continental countries of Europe with the same results.

Among other experiments performed by Carpenter were some in which cattle were muzzled to see whether warbles would develop in animals which were prevented from licking themselves. There was some difficulty in securing effective muzzling, but when this was most thorough there seemed to be an increase, rather than a decrease, of warbles in the animal.

It has been estimated that the loss caused by these pests in Europe alone amounts to millions of pounds annually; this includes deterioration of the hides, interference with nutrition and growth, and considerable loss of milk.

It may be mentioned that there is always a danger of warble flies being introduced into the West Indies through maggots coming in on imported cattle, although this is not nearly as great now as it was years ago on account of the greater attention given to cattle at the present time. An instance of the entry of these maggots actually occurred a few years ago when some of them were found on cattle imported from Canada into one of the islands. The young maggots had evidently gone into the cattle before they left the North, and the warbles only began to appear after the animals had been in the island several months. Every precaution was taken to squeeze out all the maggots before they could escape, and nothing more has since been heard of this pest in that locality.

J.C.H.

ECONOMICAL FEEDING OF PIGS.

It is clear that the feeding of pigs on foods suitable for human consumption is not at the present time in the national interest. They must be restricted as far as possible to foods which cannot be used for human beings.

Wherever possible, pigs should be turned out to pasture. The growing of special forage crops for folding with pigs, or for 'soiling', is not to be recommended at present in view of the necessity of using arable land for the cultivation of cereals.

Green food alone will not as a rule fatten pigs, but it will keep them in healthy growing condition, and save a great deal of meal. With a few weeks of sty feeding on concentrated food at the end of the grazing period prime bacon can be produced. Barren sows have actually been fattened on good pasture without any supplementary foods, and palatable pork can also be produced under the same conditions. It is necessary that pigs should be accustomed gradually to the outdoor life.

Fencing is of course a difficulty at the present time; it may, however be worth mentioning that, in the event of pigs 'nosing' under a fence, a barbed wire fixed close to the ground will prove a sure deterrent. Two strands of barbed wire fixed 6 inches and 15 inches, respectively, from the ground will effectually confine all pigs. (*The Journal of the Board of Agriculture*, July 1917.)

AGRICULTURE IN BARBADOS.

The rainfall for September has been, up to the present, a moderate one. In most districts the total for the month has been under 3 inches. In spite of the moderate rainfall for the month, the growth of the crops has not yet been impeded, although a heavy rain is needed to hasten their development.

The employment of large gangs for weeding in some districts is also a serious drawback to manure making, inasmuch as under such circumstances the collecting of bush can receive but slight attention.

We lean towards the opinion that the clearing of the weeds and grass out of the fields at the time when weeding can be conveniently and effectively done, does not receive on some estates the close attention that it should.

We have reached a stage in the history of agriculture when everything should be done that will lead to the improvement of the condition of the soil, and the consequent increase in the crops produced. The improvement of the soil was never more important than it is to-day. Scientific research has revolutionized every industry, including agriculture, in all the big centres of the world, and if we are to hold our own we must set everything in order for the race in which we run. In this connexion there are four things which are of great importance: tillage, manurial treatment, the systematic resting of fields, rotation of crops. These constitute what may be termed sugar estate economy. The output must increase when these principles are observed, while the outlay will not grow in proportion.

There has been as yet no change in the price of potatoes as the May and June sowings are not yet fit for the market. Our Christ Church correspondent wonders whether it will be possible to dispose of the potato crop when the fields in general have reached maturity. Should we have more ground provisions than could be consumed locally, we should have a ready market among our sister islands. There are some spots of early yams nearly ripe, and Indian corn flour is being sold at 4c. per pint (*The Agricultural Reporter* September 22, 1917.)



GLEANINGS.

The Annual Report of the Board of Agriculture, Bahamas, 1916-17, states that the cultivation of the sisal plant, and the production of the fibre have increased rapidly, high prices having been the attraction. Many people have planted all the slips they could lay their hands on, and are cultivating many acres of it. This industry has been a boon to the people in this war time.

The issue of *Nature* for July 12, 1917, contains a note concerning wood-boring ship worms. By far the most destructive of these is the mollusc *Teredo*. The rate at which wood exposed to its attack is destroyed is remarkable. Sound pitch pine piles driven in certain harbours on the Texas coast were destroyed in twenty-nine days. Creosoting wood as a deterrent against its ravages in no wise confers protection, while it may render cargoes of foodstuffs uneatable owing to the fumes from the wood. Copper sheathing and copper paint are the only possible agents to defeat such ravages.

The *West India Committee Circular*, August 8, 1917, states that in answer to a question in the House of Commons, Mr. Roberts, the President of the Board of Trade stated that the total quantity of cane sugar produced throughout the world in the sugar season of 1911-12 may be estimated at about 9,000,000 tons, to which India contributed about 2,450,000 tons and Cuba 1,896,000 tons. The total quantity of beet sugar produced in the same period was approximately 6,800,000 tons. In the sugar season of 1915-16 the total quantity of sugar produced may be put at about 16,500,000 tons, of which about 5,900,000 tons consisted of beet sugar.

There are about 794,000 acres under coco-nuts in the Madras Presidency, principally on the West Coast, the annual production in Southern India, including the native states amounting to about 1,000,000,000 nuts. In normal times coco-nut products valued at about £1,497,000 are exported yearly from Madras ports alone, and there is also a large local consumption. The Government of Madras has sanctioned recently the proposals of the Director of Agriculture to establish experimental farms for the investigation of problems connected with coco-nut cultivation. (*Bulletin of the Imperial Institute*, Vol. XVI, No. 3.)

Glycerine was formerly evolved from fats during their saponification in the manufacture of soap. It is said of late to have been costing about 90c. per lb. as so made. It is now asserted by the chemists that it can be made from sugar at about one quarter of the cost of its manufacture from fats, and that this has been demonstrated in Washington in the laboratory of the Department of Internal Revenue. No other known article is of more value than sugar for its nutrient qualities, but we may now find that sugar by its conversion into glycerine and thence into nitroglycerine may become one of the most deadly agents known. (*The Louisiana Planter*, July 21, 1917.)

The Cuba Cane Sugar Corporation has bought two more Luce Cane Harvesters, which are to be delivered shortly at Central Mercedes. The four harvesters that this company already owns are to be shipped to Mercedes at once, where an engineer of the Luce Harvester Company will make his headquarters and add the latest adjustments to all the machines, thus preparing them for use for harvesting cane during the coming crop. An attachment which will cut the cane in three pieces will be added, which will facilitate handling of the cane, and feeding it to the mills, and it is possible that a trailer attached to the harvester will be added, the cane to fall from the harvester directly into the trailer, carried to the headland, and loaded into carts. (*The Louisiana Planter*, August 18, 1917.)

The value of the white velvet bean (*Stizolobium Deeringianum*) as a stock food was advocated in a paper read by the Acting Chemical Assistant, Mr. R. E. Kelsick, at a meeting of the St. Kitts Agricultural and Commercial Society on July 9. This plant was used in the island chiefly as a green dressing, but the reader contended that the large yield per acre (about 2,000 lb. of shelled beans), the cheap cost of production, and the readiness with which the beans were eaten by stock suggested that they could profitably be used as a stock food, especially in view of the present high price of such foods as corn and oil meal. An analysis of the food value of the beans compared favourably with those of linseed meal, cotton-seed meal, and maize. The beans crushed and mixed with molasses, might well be employed either as a substitute for, or as an addition to, these meals in the rations of estate animals.

The papaw of recent years has sprung into prominence in Queensland. This plant like some of its tropical companions, the banana to wit, is gradually becoming acclimatized, and is slowly but surely creeping away from the equatorial zone. Among the earliest growers of the papaw in Queensland this plant was looked upon as purely tropical in habit and home, and its cultivation outside the tropics was attended with great difficulty, the mortality among the plants during the winter months reaching as high as 98 per cent. in the southern part of the State. Year by year the constitution of the plant has continued gaining in vigour, until to-day the papaw will endure a freeze of from 3 to 5 degrees of frost, without permanent damage. Having got thus far in the matter of acclimatizing the papaw, the next object to aim at is the selection of varieties that possess qualities of special merit. (*The Australian Sugar Journal*, July 5 1917.)

The *Board of Trade Journal*, August 23, 1917, states that the cultivation of cotton is being taken up with increased vigour by Queensland farmers, and a large amount of raw cotton has been received by the State Department of Agriculture for ginning. In the year ended June 30, 1916, the quantity of cotton ginned was 20,485 lb., including 6,800 lb. from New Guinea. Up to June 21, 1917, however, the Department had received 34,805 lb., from Queensland growers alone, and supplies were still coming in. In order to foster the cotton-growing industry, the Department of Agriculture purchases all raw cotton grown in the State, gins it, and then sells it on behalf of the growers. Growers are guaranteed 1½d. per lb. and, in addition, they receive any profit remaining after ginning expenses have been paid. Last year, it is said, the growers received a fraction under 2½d. per lb.

CAMPBOR OIL FROM THE FEDERATED MALAY STATES AND MAURITIUS.

In a previous issue of this Journal (Vol. XIV, No. 355, p. 395) reference was made to a peculiarity of the camphor oil produced in the Federated Malay States, that consisted in the absence of safrole, to which constituent the oil produced in Japan largely owes its commercial value, and it was suggested in the *Agricultural Bulletin of the Federated Malay States* (July 1915) from which the above information was taken, that probably the absence of safrole in the samples so far collected, was due to the fact that the distillate was obtained from young twigs and leaves in the Federated Malay States, whereas in the case of the ordinary Japanese camphor oil of commerce, the distillate is derived from old wood from mature trees.

In a recent issue of the *Bulletin of the Imperial Institute* (Vol. XIV, No. 4, October-December 1916) an account is given of the results of examination made at the Institute of further specimens of camphor oil, distilled experimentally in the Federated Malay States, and also in Mauritius. In regard to the camphor oil from the Federated Malay States, which was, as on the previous occasion, obtained from leaves and twigs, the absence of safrole was again characteristic; but an important point is brought out as to the commercial value of the oil which would seem to off-set to a great extent this apparent defect. Samples of the original oil were submitted to a firm of essential oil distillers for an opinion as to its probable value. After examination, the firm expressed the opinion that the oil should realize about the same price in the United Kingdom as ordinary brown Japanese oil, the absence of safrole in the oil being compensated by the camphor present.

With regard to the oils from Mauritius, which were obtained from leaves, twigs, and wood, the results were somewhat disappointing. No solid camphor was obtained, and the camphor wood oil was found to be quite different in characters from normal camphor oil as produced in China and Japan. Consequent on these results, a comprehensive series of distillation trials were conducted in Mauritius, and these are said to have confirmed the previous experiments, and showed that the camphor trees in Mauritius do not yield solid camphor on distillation, and that the small amount of camphor present is readily dissolved in the oil and not easily separated from it.

It was thought possible that the abnormal character of these oils might be due to the trees not being genuine camphor trees, and at the suggestion of the Imperial Institute a number of typical herbarium specimens of the trees from which the oils were prepared were forwarded to Kew for examination, with the following result, namely, that all the specimens seemed to belong to *Cinnamomum Camphora*. The Mauritius trees, therefore, are genuine camphor trees, and an explanation of the abnormal character of the oil must, consequently, be sought in other directions.

There are many references in the literature of the subject to camphor trees which do not yield camphor, but the reason for this abnormality is not at all clear. Climatic causes are possible; but it is thought to be more likely that there are certain cultural races or varieties of the species which give good yields of camphor, whilst others do not. In this connexion reference is made to Giglioli, who states in *La Canfora Italiana* (p. 72) that even in Formosa varieties exist which yield oil from which no camphor separates; and the *Bulletin Economique de l'Indo-Chine* (1907, 10, 204) states that there are two chief varieties of the camphor tree, one with green leaf stems and the other with red leaf stems, and that the latter type alone yields oil rich in camphor.

It has been suggested in France that, owing to this difficulty, camphor trees should be propagated from types known to yield camphor, by means of grafts or cuttings; but it is pointed out that experience in Ceylon, the Federated Malay States, Florida and elsewhere, makes it quite clear that it is possible to raise from seed trees giving good yields of camphor.

To meet the difficulty in Mauritius, it is proposed to obtain fresh seed for trial, and the Imperial Institute has suggested to the authorities in the Colony that it would be well to procure this from selected trees in Ceylon, or the Federated Malay States, which are known to yield camphor.

RECIPE FOR MAKING COCO-NUT BUTTER.

Although a recipe for the above was given in the *Agricultural News*, August 25, 1917, the following taken from the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, issued August 13, 1917, seems to give such clear directions in the matter that, considering the interest in the subject at present, no apologies are needed for reproducing this:—

Peel dry coco-nuts and grate into a bowl. Pour hot water on the grated material in the proportion of about 1 pint of water for each nut, and allow to stand for about one hour; then strain through coarse muslin, squeezing out all the liquid as completely as possible. Put aside in a bowl all night, or for a few hours if made during the day, by which time all the oil will have risen like cream to the top of the water. Skim the oil off, and place in a churn or wide-mouthed glass jar, and add 1 teaspoonful of salt for each nut used. Stand the jar on ice or in an ice chest, until thoroughly cold. Then churn by shaking the bottle, or otherwise, and the butter will form in about ten minutes. Turn the mass out into a cloth, mould to shape, and keep in the ice chest. If ice is not available, the butter can still be made early in the morning, and kept solid by placing it in a metal dish inside a porous pot set in the breeze with a damp cloth over it.

Some prefer to boil the grated nut after the water is added.

One ordinary nut yields about a $\frac{1}{4}$ lb. of butter.

Another modification is to add a teaspoonful of good tin butter to the cream before churning. The butter then forms more quickly, and has the colour of ordinary butter.

Coco-nut butter does not keep more than two days, and so should be made in small quantities as required.

It is a good substitute for ordinary butter both for table use and for cooking.

Coco-nut oil is made in a similar manner so far as skimming the cream off after standing. Then, instead of churning, the cream is placed in a pot, and gently heated until all the water is driven off. When cool, bottle for use.

DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture for the West Indies left Barbados on Wednesday, October 3, 1917, for an official visit to St. Vincent. Sir Francis Watts is expected to be away for a fortnight.



PLANT DISEASES.

INTERNAL DISEASE OF COTTON BOLLS IN THE WEST INDIES.

The current number of the *West Indian Bulletin* (Vol. XVI, No. 3, issued September 10, 1917) contains a paper by W. Nowell, D.I.C., Mycologist on the staff of the Imperial Department of Agriculture, which deals with the facts ascertained and the conclusions reached in the study, as yet incomplete, of an affection of cotton bolls in the West Indies, characterized by the progressive staining and rotting of the lint in green unopened bolls of healthy external appearance.

Such staining is shown to be due to the infection of the contents of the boll with certain specific fungi, previously described by the author, or with bacteria as yet undefined; which organisms gain access to the interior of the boll by means of the punctures made by bugs, mainly *Dysdercus* spp. (cotton stainers) and *Nezara viridula* (green bug).

Four species have been found, referred to for the present by the letters A-D. All bear elongated spores in sporangia which originate as expansions of simple hyphae. In species A the spores show no orderly arrangement. In species B they occur in two conical bundles interlocking at the base; this form appears to correspond with *Eremothecium cymbalariae*, Borzi. In species C and D the spores typically lie in two equal groups end to end, some distance apart but connected by the whip-like appendages of the spores. The thallus of species A-C is typically hyphal; that of D is typically yeast-like, but assumes the hyphal form under some circumstances. Species closely resembling D have been described as forming the genus *Nematospora*. Both the genera named occur so far as is known only in fruits.

In bolls which are approaching to full size, and in which the lint is well developed, the result of an infection is the production of a stained patch due to the growth of the invading fungus or bacterium on the lint. According to circumstances this may be small, or may, alone or with other infections, spoil the contents of the whole lock. The effect on younger bolls is more uniformly severe, owing to the more susceptible condition of the boll contents, and the longer time afforded for the growth of the invading organism. Many such bolls are shed before maturity, and in the remainder the contents of the infested locks are more or less completely rotted.

The prevalence of the affection is much greater in some islands than in others, and in some seasons than in others. Heavy losses from the disease are experienced only in the second half of the picking season. In the years and situations most marked by its prevalence the losses in the first picking of May-planted cotton (September-October-November) are commonly negligible, and have not been found to exceed 20 per cent. in the local outbreaks which have occurred, but during the second picking (November-December-January) they rise very rapidly and in the last-mentioned month may be close upon 100 per cent. The yield of early planted cotton is thus not seriously affected but that of late cotton is, on occasion, almost totally destroyed.

A review of the entomological literature of the subject shows that the idea once generally held that plant bugs give rise to staining of cotton by means of their excrement and

through being crushed in the gins has been widely questioned, but that no convincing explanation has been offered of the extensive staining often experienced in connexion with bug attacks.

Certain pathologists have suggested that insect punctures afford means of entrance for boll-rotting bacteria.

The occurrence in the West Indies of internal boll disease as defined in this paper was noted in the year following the resumption of cotton growing in 1902. The affection has since been found to be generally distributed in the British islands where cotton is grown, from Jamaica through the Lesser Antilles to British Guiana.

Experiments have demonstrated without exception the dependence of the disease on the infection of bug punctures. It seems most probable that, at least in the case of the fungi concerned, the infecting organisms are carried by the bugs themselves.

Under ordinary conditions fungoid infections greatly predominate over those due to bacteria, but under circumstances which appear to be connected with wet weather, the proportion of the latter may be largely increased. Weather conditions have not been found to affect the occurrence of fungoid infections.

The results of plant bug attacks on the boll, as seen when the punctures have remained uninfected, are (1) the production, observed in young bolls only, of dead brown patches of lint, which are small and localized; (2) the occurrence of proliferated tissue on the inner surface of the carpels and on punctured seeds; (3) the death of a certain number of seeds in bolls severely attacked. The amount of stained lint produced in this way is negligible. The returns of stained lint obtained in these islands are mainly due, in varying proportions, to (a) internal boll disease, and (b) ordinary bacterial disease. The latter only becomes serious in wet weather.

The varying incidence of the disease is shown to depend in general on the relation between the time of planting, the length of the crop period, and the time when infestation with stainers occurs.

The infestation of the cotton fields with stainers originates from waste land on which their wild food-plants exist, and proximity to such a source leads to earlier and more severe invasion. Migratory flights of stainers, with an unknown range, have however been observed.

The principal food-plants on which the stainers breed freely out of the cotton season are the silk-cotton tree (*Eriodendron*) and the mahoe (*Thespesia*); they also breed to some extent on various Malvaceous herbs or shrubs. They feed, without breeding, on a large variety of other plants.

An addendum to the paper states that when this was already in print specimens of diseased tomatoes and cowpeas, received from the St. Vincent Experiment Station, were found to be heavily infested, the tomatoes with species A and the cowpeas with species D. In both cases the fruits were externally sound, but bore small scars such as would be produced by bug punctures, and had internal proliferations. On cutting open an affected tomato one or more sectors were found blackened, the placental tissue and the seeds infested with the fungus, and the juice charged with very numerous spores. In the case of the cowpeas, many seeds still succulent showed a brown dot on the testa with a circular fungus infestation on the cotyledon beneath. The subsequent growth of the fungus shrivels the cotyledons very severely by the time the seed should be ripe. A total loss of crop on one plot of cowpeas is reported which, according to the specimens sent as representative, was due almost entirely to this affection.

THE BIOLOGICAL FACTORS AFFECTING COTTON PRODUCTION IN ST. VINCENT.

The principal contents of the *West Indian Bulletin*, Vol. XVI, No. 3, just issued by the Commissioner of Agriculture, consist of three interrelated papers which have reference to cotton growing in the West Indies. Summaries of Mr. W. Nowell's paper on the internal disease of cotton bolls, and that of Mr. W. N. Sands on the cotton stainer, will be found on pages 318 and 308 respectively, of this issue. Mr. Harland's paper, based on the manurial experiments with cotton at the St. Vincent Experiment Station, extends to a detailed presentment and discussion of observations made during the past season on the factors affecting the yield.

The results of the manurial experiments proper are:—

(1) That all the manurial plots show an increased yield, which in the case of the phosphorus-potassium-cotton-seed meal plots in the year under review amounted to 116 per cent.

(2) That the element most needed in the plots is potassium, application of which gave an increase of 76 per cent. Shortage of potash showed clear effects on the plants in several plots by leading to the production of reddish-coloured leaves with a tendency to drop prematurely.

(3) Phosphate and potash was less beneficial than potash alone.

(4) Artificial and cotton-seed meal proved better than either alone.

(5) Cotton-seed meal alone at the rate of 500 lb. to the acre has been shown to be insufficient to meet the full requirements of the plants when grown on the same land for a number of years.

Perhaps the most important conclusion reached, which was rendered possible by the detailed nature of the studies, is that differences in manurial treatment do not cause any notable differences in the percentage of flowers producing ripe bolls.

The second and principal section of the paper is concerned with the biological factors, apart from manuring, which affect the yield, and is of great interest and importance. The number of flowers opening daily in each plot of the manurial series was recorded, and the production of bolls was similarly observed. From these data a graphic representation (Plate 1) of the flowering and bolling curves of the plots has been constructed, which affords a definite picture of the process of events during the course of the season.

The first flowering curve (October-November) is followed at an interval of some fifty days by the corresponding bolling curve of the first picking, and the contrast between the areas enclosed by the two curves illustrates in a striking manner the very great difference commonly experienced in St. Vincent between potential and actual yield. The second flowering curve (December-January) which is of considerable dimensions, represents a capacity for production on the part of the plants which is totally lost, for the reason that infestation with internal boll disease becomes complete during January, and makes the keeping of the plants beyond that month quite useless.

For the purpose of detailed analysis of the losses occurring during the effective part of the growing season a daily examination of some thirty plants was made, and, as far as possible, an accurate record was kept of the fate of every bud, flower, and boll produced. The record of one plant is reproduced in full (Plate 2), and the records of seventeen plants, including for comparison Upland and hybrid types, are given in abbreviated form (Plates 3-6). Only about 20

per cent. of the flowers matured into bolls. The principal cause of loss of crop in the effective period is the shedding of buds and bolls. Heavy shedding took place in the latter part of October and throughout November, of which the shedding of buds and young bolls is attributed to the physical effects of the heavy rains which fell during that period. Very considerable losses of older bolls occurred from shedding induced by the presence in the boll of the external (bacterial) boll disease, and of the internal boll disease. Of these three factors leading to shedding, and responsible for the serious reduction of the first picking, the first two are dependent on wet weather, while the third, internal boll disease, depends mainly on the prevalence of the cotton stainer bug. The weather tends to be drier towards the end of the year, but the good effects which might be expected from this, and which could be secured in increased measure by late planting, are nullified by the increase in the number of stainers and the corresponding prevalence of stainer-borne disease. The welfare of the cotton industry in St. Vincent thus depends, in the last resort, on the control of stainers.

The study of the internal boll disease by Nowell, and that of stainers by Sands, are thus closely related to the general problem as revealed by Harland's observations, and the three papers afford an example of that correlation of ecological, pathological and entomological effort of which the desirability is indicated in the editorial on another page of this Journal.

From the analysis of the conditions in the various islands made in the paper on internal boll disease, it will be seen what widely different results are produced from differences in the combinations of the factors concerned, so that, to take extreme examples, a matter which is vital for St. Vincent has hardly any significance for St. Kitts. The history of this investigation illustrates, moreover, the very real value of the co-operation between the islands in the collection and distribution of information which is secured by the existence of a central Department of Agriculture.

THE SUGAR MARKET.

The following information concerning the sugar situation is abstracted from the latest report to hand of Messrs. Gillespie Bros. and Co., dated New York September 14:—

The uncertainty regarding the future still tends to check business, and while there are offers of September shipments at 5½c. per lb. c. & f., there was no buying interest displayed here for the shipment positions. Canadian refiners accepted a little business for fairly prompt shipment at this figure, and we have buyers here for immediate shipment at the same price, but so far the lowest offers for this position are at 6c. c. & f. for basis 96° centrifugals. Porto Ricos are offered at 6.00c. per lb. with buyers at 6.77c., the market being fairly steady around these levels. The chief matter of interest affecting this product is the advices from Washington of the elimination of the consumption taxes and clause repealing the drawback.

Most of the refiners have been in session this week with the Food Commissioner, and it was expected in some quarters that arrangements might be made whereby the balance of the present Cuban crop could be purchased and distributed among the several interests without competition among themselves.

All export business is at a standstill owing to the requests of the Government to discontinue all export shipments until sugar becomes more plentiful.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
July 26, 1917.

ARROWROOT—5d. to 7½d.
BALATA—Block, 2/9- to 3/4½; Sheet, 3/10½ to 3/11.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, 41d. to 45d. per lb.
FRUIT—Bananas, no quotations; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
ISINGLASS—No quotations.
LIME JUICE—Raw, no quotations; concentrated, no quotations; Otto of lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—1/3 per lb.
NUTMEGS—10½d.
PIMENTO—3¾d. per lb.
RUBBER—Para, fine hard, 3/2½; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., August 8, 1917.

CACAO—Caracas, 12c. to 12½c.; Grenada, 11½c. to 12c.; Trinidad, 11½c. to 12½c.; Jamaica, 9½c. to 9¾c.
COCO-NUTS—Jamaica and Trinidad selects, \$32.00 to \$33.00; culls, \$22.00 to \$23.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 75c. to 80c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 65c. to 70c. per lb.
GRAPE FRUIT—Jamaica, \$2.75 to \$3.50 per box.
LIMES—\$6.50 to \$7.00 per brl.
MACE—38c. to 42c. per lb.
NUTMEGS—20c. to 21c.
ORANGES—\$1.75 to \$3.00.
PIMENTO—5½c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 7.52c; Muscovados, 89°, 6.66c.; Molasses, 89°, 6.50c, all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., August 24, 1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.50 to \$13.00.
COCO-NUT OIL—\$1.25 per Imperial gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—No quotations.
DHAL—No quotations.
ONIONS—\$7.00 per 100 lb.
PEAS, SPLIT—\$11.00 to \$12.00 per bag.
POTATOES—English, \$5.00 per 100 lb.
RICE—Yellow, \$10.00 to \$10.75; White, \$7.00 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., September 18, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—No quotations.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$8.25 to \$9.00.
RICE—Ballam, \$10.00 to \$10.80 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$6.00 to \$6.50.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SAND BACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



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Making and Storing Farm-yard Manure.

WHETHER there is a farmer in any part of the world, whatever the crop he cultivates, he has to face the question of preserving or increasing the productiveness of his land. The fact that the fertility of soil decreases after continual taking crops off it was recognized long before the reason of this decrease was known, and the practical method of preserving fertility by the application of manure was acted on probably long before the beginning of history. It is certain that the earliest writers on practical agriculture whose books have come down to our age knew the value of farm-yard manure, and

gave directions about its use as the great fertilizer of the soil.

Varro, who lived from 116 to 27 B.C., has been called the father of agriculture, because of his treatise in three books *De Re Rustica*, which treats systematically of agricultural practice, and is the earliest work of the kind which has survived to the present day. He has much to say about the art of managing the manure on a farm. He insists on two points: first, that the manure should be rotted before being applied to the land, and that there must therefore be two heaps—one fresh and one rotted; secondly, that the heaps should be kept moist by allowing water to run on to them, and by protecting their sides with twigs and leaves. Columella, another Latin writer, whose treatise in twelve books, under the same title as that of Varro's, has also survived to our day, gives many directions as to the storing and utilization of farm-yard manure. He gives instructions as to the manner of constructing the place or pit where the manure is to be kept, and also emphasizes the necessity of applying only rotted manure to corn, although fresh manure might be well applied to grass. These precepts of Varro and Columella became the recognized method of dealing with farm-yard manure through Europe until well into the 18th century. This practice may be summed up as follows:—

- 1.—The manure must not be allowed to become dry.
- 2.—It must be rotted before being applied to corn.

No attention was paid to bad effects of rain on a manure heap, as neither of these authors had anything to say about it.

A paper in *The Journal of the Royal Agricultural Society of England*, Vol. 77, 1915, by E. J. Russell, D.Sc., and E. H. Richards, from which the present article largely draws, deals with this subject from the point of view of results of experiments during the previous three years at Rothamsted and Cambridge.

The subject is of quite as much importance to modern agriculturists as it was to the ancients, and to those of tropical countries as to those in the temperate zone. For not only is farm-yard manure the most widely used fertilizer, but the amount used much exceeds both in weight and value that of all other fertilizers put together. In the United Kingdom alone the weight of farm-yard manure made use of in the year before the war was estimated at 37,000,000 tons, valued at £11,000,000, while the weight of all other fertilizers used was 1,105,000 tons, valued at £4,540,000. In most other agricultural countries the proportion of farm-yard to artificial manures used is probably still greater. Seeing then that farm-yard manure is of such prime importance in agricultural economy, it is evident that waste of its most valuable constituents should be minimized as much as possible. Unfortunately this is, under ordinary conditions of making and storing, very considerable. Investigation into the causes of this wastage is by no means easy, for farm-yard manure is variable in composition, and difficult to sample and analyse satisfactorily, so as to obtain reliable conclusions. The problem is being definitely attacked however, and some definite results have been reached.

It must be remembered that, apart from litter, straw, etc., added to it, what is known as farm-yard manure is made up of two kinds of excretions; the solid fæces, which is the undigested material that the animal's alimentary canal has been unable to deal with; and the urine, containing the digested material, after it has been dissolved, assimilated, and passed out of the animal's body.

Now modern analyses have shown that the urine contains a far greater percentage of the most valuable fertilizers, nitrogen and potash, than the solid fæces; and further that the nitrogen and potash of the urine are of more fertilizing value than the same constituents of the fæces, because the former are already dissolved, and capable of immediate assimilation by plants.

It is impossible, however, in making farm-yard manure to collect all the urine; consequent on this are the differences noted in analyses of farm-yard manures. It has been demonstrated, however, that the manure

coming from animals well fed on oil cake is richer in nitrogen and phosphates than that from animals deprived of such nitrogenous food.

Experiments at Rothamsted were planned for the purpose of finding out how to preserve the best elements in farm-yard manure. In the first place it was demonstrated that a manure heap should be compacted as a measure of precaution, because the loss of nitrogen and phosphates from a compacted heap, as compared with that from a loose heap, shows that the expense of compacting is quite justified. The common practice in the West Indies of keeping the manure in the cattle shed until wanted for use, is to be commended in this connexion. The continual trampling of the cattle does much towards effective compacting.

The next series of experiments was to discover whether sheltering of a manure heap from weather and rain was of any benefit. Here the results showed that between unexposed and exposed manure there was a very great difference, emphasizing the necessity of shelter for manure heaps. The conclusion drawn from this series of experiments is that the provision of shelter for the manure heap is very important, and that serious losses arise when manure is exposed to the weather. Compacting the heap only slightly diminishes the losses; the only way of dealing with them is to provide a shelter of some sort to the heap.

An objection to sheltering a manure heap is that it tends to make the manure too dry, which is correct to a certain extent, inasmuch as dryness tends to encourage nitrate formation, which is not especially desirable, and to discourage the decomposition of the litter, which is eminently desirable. But to try and add water to a sheltered heap only makes matters worse; the loss of nitrogen only becomes more marked. Direct field experiments show that the best course to pursue is to shelter the manure heap, but to check the tendency to become dry by keeping it as compact as possible.

Further experiments showed that manure retains its fertilizing constituents best when it is:—

- a. Kept compact;
- b. Sufficiently moist, but not too wet;
- c. Under shelter, and not stirred up.

Yet all these precautions only retard inevitable loss. So the question is, can not the loss in the beneficial constituents of manure be altogether avoided?

Experiments designed to find out what processes go on in a manure heap, and why losses arise, have to

be carried out primarily in the laboratory. But what is discovered in the laboratory holds good in the field. From careful laboratory experiments the following conclusions were arrived at:—

1. The loss of nitrogen from a manure heap is partly due to three causes: (a) the washing away of soluble substances; (b) the volatilization of ammonia; (c) the liberation of some other gas, presumably gaseous nitrogen.

2. These losses begin as soon as the air is allowed to enter the heap, and they become more intense as the temperature rises.

3. The losses do not take place when air is completely excluded from the manure.

4. When air is completely excluded, and the temperature is caused to rise, not only is there no loss, but a distinct improvement in quality takes place.

Both the laboratory analyses and field experiments thus show that exposure to atmospheric influences causes a loss in quantity and quality of the manure. No manure heap, however, has yet been made which will absolutely meet the conditions of conclusions 3 and 4. Still it is clear that it is to the advantage of the farmer to endeavour to store his manure in such a way as to approximate to those conditions as nearly as possible.

The common method of making up manure in the open with no shelter over it must be condemned, as most surely causing very considerable loss in quality. There is no question but that some shelter from rain is most necessary, and that the heap should be compacted as closely as possible. In all cases special care must be taken of any liquid draining away from the manure heap. Some kind of a tank ought to be made to hold it. This liquid should not be poured back on the manure except just before spreading, but it ought to be applied to the land separately. The use of this and of urine as liquid manure produces excellent results.

Even with these precautions it is still certain that large wastage takes place at present in the making and storing of farm-yard manure. The laboratory experiments show that not only can manure be stored with out loss, if air and water are completely excluded, but that positive gain in quality is produced, if, in addition, the temperature is raised. The conclusion, therefore, is that the only method of excluding the air in practice would be to store the manure in air-tight tanks or pits.

In the West Indies the question of increased temperature is arranged for by nature. The details of construction of such tanks or pits would have to be carefully worked out, so as to discover how far the gain in fertilizing power of the manure would counterbalance the expense of such a tank or pit. It would seem however, that any attempts to avoid loss in making and storing manure will have to be on these lines, and the possible gain to the farmer makes it a subject worth most careful attention.

POSSIBLE USES OF BY-PRODUCTS OF THE SUGAR INDUSTRY.

An article in the *Louisiana Planter*, August 25, 1917, under the above heading gives an outline of feeling in Hawaii on the subject. It says that the *Hawaiian Planter's Record* thinks that there are possibilities involved which should be considered at a time like this. Such possibilities might also deserve consideration by those who are interested in the sugar industry in the West Indies.

The following data are given: The potash alone contained in the molasses that the Hawaiians produce each year amounts to about 5,100 tons. The value of this at the present time would be approximately \$2,550 000, or under normal conditions, \$510,000. Under normal conditions they import each year about 4,800 tons of potash for fertilizer. The potash in their molasses, therefore, is 300 tons in excess of their annual importations of this material. The same is true to a lesser extent of nitrogen and phosphoric acid. In manufacturing potash from molasses an additional value may be obtained in the form of fuel either direct or as alcohol.

One ton of molasses will produce 60 gallons of alcohol, now worth approximately \$36, or 60c. a gallon. Under normal conditions its value would be \$19.80, or 33c. a gallon. Used as a substitute for gasoline it would be worth \$12, or 20c. a gallon. When properly handled alcohol is equivalent, gallon for gallon, to gasoline. The residual potash left over from the manufacture of alcohol from 1 ton of molasses is 80 lb. At the present market price this would be worth \$20. Under normal conditions it would be worth \$4.

The fuel value of the annual Hawaiian output of molasses is equivalent to 25,500 tons of coal. The fuel value of 1 ton of molasses is equivalent to 1 ton of bagasse, or $\frac{1}{5}$ of a ton of coal. The potash contained in 1 ton of molasses which could be recovered on burning is 64 lb. (80 per cent. recovery). This is worth, at the present market price, \$16, or 25c. per lb. Under normal conditions it would be worth \$3.20, or 5c. per lb.

In connexion with the question of employing molasses as a source of industrial alcohol to take the place of petrol as a fuel, the Australian Commonwealth Advisory Council of Science and Industry draws attention to the fact that the cheapest source for the production of such alcohol in Australia is sugar molasses. We publish in another column the report of the Committee of that Council appointed to deal with the subject.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. Mr. Joseph Jones, the Curator, in his report for the month of September, states that the following distribution of plants has been made for the month: limes, 3,875; shade trees, 500; cacao, 100; budded citrus, 16; grafted mangoes, 4; miscellaneous, 10; making a total of 4,505. In addition 189 packets of vegetable seeds were sold.

The local price paid for ripe limes has risen from 4s. to 6s. per barrel.

With the assistance of the entomologist (Dr. J. C. Hutson) investigations were carried on in connexion with the mango maggot, and the wood-boring beetles which attack puncheons in which lime juice is shipped.

Eleven boxes of limes and 10 boxes of oranges have been shipped to London for the use of the wounded in hospitals.

The rainfall for the month totalled 15.02 inches, 5.74 inches of which fell on the 20th.

MONTSERRAT. It is reported by Mr. W. Robson, the Curator, that a storm of considerable severity passed over the island on the morning of September 21. The wind was at its highest between 2 a.m. and 4 a.m., the barometer falling at Grove Station to 29.776. The rainfall was 5½ inches at the same station, but was much less on the windward side of the island. The damage to the cotton crop in Montserrat, with the possible exception of the windward district, is not regarded as serious, but some of the plants in that portion of the island have been almost stripped of leaves, and there will probably be a considerable reduction in the yield as the result.

In his monthly report Mr. Robson states that the following plants have been distributed from the station: bay plants 950; mahogany 19; together with 20 lb. of pigeon peas, and 20 lb. of sword beans. Vilmorin's Stringless Bonavist Bean, received from Demerara, promises to be quite an acquisition.

The prospects of the cotton crop remain fair in all parts of the island. There has not been much trouble with cotton worm, and cotton stainers are only troublesome in one or two places. Seed-cotton is fetching locally 10d. per lb., giving a further stimulus to the interest of the small growers. Very considerable areas are now being cultivated on the half-system.

Less attention is being paid to the papaw industry, in fact to all minor industries, on account of the present boom in cotton.

Four distillations of bay leaves were made with the usual results. Samples of the oil obtained were forwarded to the Government Laboratory in Antigua for examination. The rainfall at Grove Station has been 13.14 inches for the month, making a total for the year of 53.85 inches.

ANTIGUA. The distribution of plants from the station is reported by Mr. T. Jackson, Curator, as having been as follows: 820 bay plants, 58 decorative, 49 economic. There were also distributed 791 lb. of cotton seed during the month. With regard to the cane crop, Mr. Jackson reports that the outlook is fairly promising, perhaps, however, not quite as good as at this time last year. The cotton crop is fair. It is felt that the non-arrival of onion seed may have a serious effect on next year's returns of this industry. Nursery beds and land

in which to plant this crop are fully prepared. The payment made by the Antigua Onion Growers' Association for onions delivered at their premises during the last crop was approximately at the rate of 2d. per lb.

Agricultural instruction to the peasants in the English Harbour district was continued during the month, the peasants being busy with completing the sowing of cotton. The reaping of corn still continues in this locality, and the peasants are disposing of their corn locally at a remunerative price. Two more plots of land have been taken up during the month at Sawcolts.

As far as Antigua is concerned, practically no damage was done by the cyclonic disturbance of September 21. It is noted, however, that in Christian Valley the banana cultivation suffered a good deal, many plants having been blown down.

The rainfall for the month was 4.40 inches; for the year, 22.04 inches.

BARBUDA. The growth made by the cotton plants in both the districts of this island where there is an area of about 60 acres under cotton is decidedly encouraging. The prospects of the cotton crop are excellent.

A number of bay trees have been satisfactorily transplanted. A heavy return is expected to be reaped from the fields cultivated in corn. The rainfall for the month was 4.17 inches.

The Agricultural Instructor reports that the peasant growers are showing much interest in the cultivation of cotton. 160 lb. of cotton seed having been distributed among them. They have also reaped fair crops of corn and peas from their grounds. Two small experiment plots, 1/10-acre in area, planted in black-eye peas, have been reaped, giving a calculated yield of 671 lb. of shelled peas per acre.

ST. KITTS. The Agricultural Superintendent, Mr. F. R. Shepherd, reports the distribution from the station of 500 sweet potato cuttings, 30 lb. white velvet beans, 9 lb. cow-peas, and 19 ornamental plants.

The picking of the cotton crop is in full swing; excellent returns are being obtained. The plants suffered no damage from the wind of September 21, and not enough rain fell to affect the lint. Some of this season's cotton has already been sold at 3s. 6d. per lb. lint. There have been shipped, via New York, 500 bales of last season's cotton.

Special work in connexion with counting flowers on cotton plants on manurial plots, and records of individual plants is being continued. Cotton is being carefully picked from selected plants in progeny rows.

The damage done by the recent gale was comparatively slight; some young cotton in exposed places was shrivelled, but on the whole, there has been little damage done to the crop. The canes in the upper lands were lodged to some extent, but it is not considered that the crop will suffer any loss thereby. There was very little rain during the gale, only .97 inches. The rainfall for the month was 7.54 inches, making a total for the year to date of 30.40 inches.

NEVIS. The cotton in the demonstration plot is being reaped, Mr. W. I. Howell, the Agricultural Instructor, reports, and the crop is estimated to give a yield of 200 lb. of lint per acre.

It seems doubtful from the appearance of the onions planted from seed obtained from Kew, whether a satisfactory crop will be obtained.

For the purposes of experiment seven varieties of sweet potatoes have been planted in small plots, each 1/32-acre in extent. The following distribution of plants had been made during the month: Lima beans, 14½ lb.; black-eye peas, 5 lb.; Para peas, 21 lb.; cotton seed, 160 lb.; together with 22 shade trees.

Although the young canes have improved somewhat, the crop, on the whole, is unsatisfactory; the ratoons especially are very poor. The hurricane of September 21 did no very serious damage to the cotton crop. Cotton stainers are observed in a few fields. Cotton picking has begun in several fields, and good yields are being obtained.

Provision crops are in a satisfactory condition. Some new fields of sweet potatoes have been planted. The rainfall for the month has been 8.18 inches, making a total for the year of 34.90 inches.

ALCOHOL AS A SUBSTITUTE FOR PETROL.

In April last the Commonwealth Advisory Council of Science and Industry appointed a special committee of experts to inquire into the production of industrial alcohol in Australia, and the design and manufacture in this country of engines suitable for using alcohol in place of petrol. This committee has now issued its first progress report. The committee draws attention to the fact that alcohol possesses various advantages over petrol as a fuel. In the first place the products of combustion in an alcohol engine are practically odourless and free from smoke. Secondly, the risk from fire in storing and handling alcohol is much less than in the case of petrol. Thirdly, there are many theoretical, chemical, and physical reasons why alcohol should yield superior results. It can be used without danger of pre-ignition under high compression, and it can yield a much higher percentage of its available heat content in the form of work. Lastly, alcohol is produced in Australia, and, if necessary, can be manufactured here in largely increased quantities.

The main aspects of the problem that have to be solved are—(a) the design and manufacture of the engine; (b) the supply of alcohol and its distribution; and (c) the denaturation of the alcohol, so as to render it impotable.

The engine problem does not present any serious difficulties, as alcohol has been used for a number of years with success in other countries, notably Germany. The main difficulty is that alcohol engines cannot be started cold, and some special device for pre-heating is necessary. The committee is taking steps either to purchase or have constructed an engine or engines, and to use them for demonstration purposes.

The supply of alcohol is a much more difficult problem than its utilization. At present the cheapest source for the production of alcohol in Australia is sugar molasses, but even if the whole supply of molasses were used, it would be sufficient to produce only about 4½ million gallons of alcohol, whereas the annual importations of mineral oils are about 17 million gallons. If petrol is to be replaced by alcohol, it will, therefore, be necessary to use some source in addition to, or in place of, molasses. If alcohol cannot be profitably made from waste or raw materials not at present used, such as prickly pear, sawdust and waste timber, grass trees, waste fruit and vegetable refuse, it will be necessary to grow special materials for the purpose. The most likely of these are maize, potatoes, wheat, barley and beet. The committee is investigating the cost of production, on a commercial scale, of alcohol from various sources.

The denaturation problem also presents considerable difficulties. Under the present excise regulation alcohol has to be mixed with other ingredients to render it impotable before it can be sold as methylated spirits. If alcohol is to come into general use as a fuel, it will be necessary to find

some cheaper denaturants than those now used, otherwise the excise regulations will make the price of fuel too high. If these difficulties are met in a liberal and progressive spirit there is no doubt that they can be overcome. When this is achieved, not only will Australia cease to be dependent on other countries for a fuel which is essential, but many new industries will open out, both directly and indirectly, as a result of the change. From the Imperial point of view it is important to secure uniformity in regard to denaturation, so that industrial alcohol distilled in one part of the Empire may be exported for use in other parts. With this object in view the committee is co-operating with the Imperial Motor Transport Council, London. (*The Australian Sugar Journal*, August 9, 1917.)

AGRICULTURAL RETURNS FOR ENGLAND AND WALES, 1917.

The following memorandum was issued by the Board of Agriculture and Fisheries on August 25, 1917. It is of interest at the present time to the whole Empire:—

The Preliminary Statement of the Agricultural Returns for England and Wales, collected in June last, shows that about 190,000 acres of permanent grass have been brought under the plough since June 1916, the arable area being 195,000 acres more than a year ago.

The acreage under wheat is slightly greater than a year ago, a decrease of 53,000 acres in the autumn being rather more than counterbalanced by increased spring sowings. Barley and oats are being grown more extensively than last year, the former showing an increase of 128,500 acres, and the latter, one of 173,000 acres; the area under oats is the largest recorded since 1904. Of the pulse crops, beans have been reduced by 25,000 acres, and peas increased by 18,000 acres, as compared with last year. The acreage under potatoes has been increased by 80,000 acres, or nearly one-fifth, and is about 10 per cent. greater than the highest previously recorded. The area under roots has also been extended, turnips and swedes by 34,000 acres, and mangolds by nearly 11,000 acres. Green fodder crops have been grown on reduced areas. Mustard has lost the large increase recorded last year, and the area is now below that of 1915. Bare fallow was reduced by 66,500 acres. The area of clover and rotation grasses is 90,000 acres less than last year, nearly all the reduction being in that reserved for hay. The area from which meadow hay was taken also shows a reduction, and altogether the hay area is down by nearly 108,000 acres.

The number of horses on farms increased by 13,000, those used for agricultural purposes showing an increase of 23,000. There are, however, 5,000 less foals than in 1916. The total number of cattle has again been increased, and is the largest ever recorded. The number of cows in milk on June 4 was 24,000 less than a year ago, but the total dairy herd is 35,000 larger, the number of heifers carrying their first calves having been increased by nearly 40,000, whilst there were nearly 20,000 more cows in calf but not in milk. Both calves and cattle from one to two years old, have been reduced in numbers, while those over two years have increased. Sheep show a considerable reduction, the number of ewes kept for breeding declining by 170,000, and lambs by 570,000. Both sows and other pigs were being kept in smaller numbers, and the total number of pigs was 250,000 less than last year.

COTTON.

SEA ISLAND COTTON MARKET.

Messrs. Wolstenholme and Holland, of Liverpool, write as follows, under date September 17, 1917, with reference to the sales of West Indian Sea Island cotton:—

In the absence of stock, no business is reported in West Indian Sea Island, but there are eager buyers, as spinners are without stock.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending September 15, 1917, is as follows:—

ISLANDS. The receipts are practically nil, being only 2 bales, consequently there is no market as yet. It will be probably several weeks before there is sufficient movement to admit of any offerings.

GEORGIAS AND FLORIDAS. The market in Savannah has not opened, the small sales reported there being chiefly old crop cotton. The business done so far has been in the interior markets at very irregular prices, some sales having been made in the early part of the month on a basis of Extra Choice to Fancy 69c. landed, but since then recent sales have been at 65c. landed. At this decline there is still no general buying, the trade being disposed to delay coming into the market, hoping for a lower range of prices.

The following quotations are based on the sales made recently, viz.:—

GEORGIAS AND FLORIDAS.

Fancy	63c.
Extra Choice	62c.

The exports from Savannah to date were, to Northern Mills 123 bales, Southern Mills 66 bales, and from Jacksonville to Northern Mills 642 bales.

CROP ADVICES. During the past month the weather has been favourable, excepting too much rain in some sections. The boll weevil has done much damage in South-western Georgia, and the outlook there is very unfavourable for the crop, but in other sections of the State, as well as in Florida and Carolina, the promise is for a good yield. The increased acreage planted may partly, if not wholly, offset the ravages of the boll weevil in Southern Georgia. However, crop estimates have a very wide range, and the total output is estimated from 100,000 to 130,000 bales.

BRITISH COTTON GROWING ASSOCIATION.

The one hundred and sixty-third meeting of the Council of the British Cotton Growing Association was held at the Offices, 15, Cross Street, Manchester, on Tuesday, September 4. In the absence of the President (The Rt. Hon. The Earl of Derby, K.G.) Mr. J. Arthur Hutton occupied the Chair.

Reference was made to the death of Mr. John E. Newton, who was formerly Chairman of the Association, and a resolution was passed expressing the deepest sympathy of the Council with Mrs. Newton and family in their sad bereavement.

FUTURE OF THE COTTON-GROWING MOVEMENT. It was reported that the Empire Cotton Committee had now been appointed by the Government, and that they had already held two meetings.

SUDAN. The negotiations with the Government for the development of the irrigation scheme for the Gezira plain are still under consideration, and it is hoped that a satisfactory settlement will be come to shortly, so that the work will be pushed on without any further delay. Of all the schemes which the Association have under consideration this is the only one which offers any possibility of a large production of high-class cotton within a reasonable time. In view of the dangerous position of our future supplies of cotton, it is considered absolutely essential that the work should be pushed forward with as little delay as possible.

WEST AFRICA. A letter from Sir Frederick Lugard, the Governor of Nigeria, was read, stating that it would be disastrous to the cotton-growing industry of Nigeria if anything were to happen to prevent the exportation of cotton to the United Kingdom, and that he views the situation with great anxiety. The Governor points out that the industry, though still in its infancy, has been steadily built up and fostered by the untiring labours of the Association and the whole-hearted support of the Nigerian Government, and it is only within the last few years that the results of these endeavours have begun to show themselves in the increased output and added confidence of the native producers, and should any check be experienced in buying this year's crop, the whole of this labour will be wasted, and cotton growing in Nigeria will receive a set-back from which it will take years to recover. A report was read on cotton cultivation in the Northern Provinces of Nigeria for the year ending December 31, 1916, by the Director of Agriculture for Northern Nigeria, in which the Director expresses satisfaction that the optimistic terms of his previous report have been amply justified by subsequent events, and that the year 1916 has proved by far the most successful in the annals of the Northern Provinces so far as cotton production is concerned. The amount of ordinary cotton seed distributed free to natives by the Association during the past three years is as follows: 1914, 269 tons; 1915, 147 tons; 1916, 290 tons.

Various reasons are put forward to account for the largely increased purchases at Zaria in 1916, as compared with previous years, and among the explanations may be mentioned the following:—

(a) That owing to the low prices offered for groundnuts during the period following the declaration of war, there was a scarcity of money in the North with which to buy cotton for the native spinning industry.

(b) That lack of purchasing power was also experienced owing to the mines restricting their operations and reducing their purchases of local cereals.

(c) That the increasing use of English cotton goods reduced the demand for raw cotton locally, and therefore left a greater surplus for purchase by the Association.

(d) That a greater area of cotton was planted.

(e) That the great scarcity of food in 1913 and 1914 caused the value of all local produce to rise to famine prices, and that the price of cotton rose in sympathy with all other products. The years 1915 and 1916 were years of plenty, and prices fell to such a low level that the 1d. per lb. given by the Association became acceptable to the native, who during the two previous years had scorned the same offer.

The Director of Agriculture states that the purchases in 1917 may not come up to expectations on account of the unfavourable climatic conditions, but there will be an increase of at least 500 per cent. in the quantity of long-stapled cotton which is being grown under the auspices of the Government Agricultural Department.

The purchases of cotton in Lagos to August 31 amounted to 7,702 bales, as compared with 9,104 bales for the same period of last year, and 5,748 bales for 1915.

The purchases in Northern Nigeria to July 31 were 3,673 bales, as compared with 10,499 bales for the same period of 1916, and 467 bales for 1915.

UGANDA. Cotton is now being shipped in larger quantities from East Africa, and it is not anticipated that there will be any great difficulty in shipping the balance of the 1916-17 crop. It is quite expected that the exceptionally high prices which have been paid to the natives for cotton during the past season will result in an increased area being planted with cotton, and the demand for cotton seed fully bears out this view. It is hoped that some means will be found of overcoming the shipping difficulty.

PROHIBITION OF EXPORTS OF SEA ISLAND COTTON.

In consequence of the following telegram from the Secretary of State for the Colonies, the Governors of the West Indian islands concerned have issued Proclamations prohibiting the exports of Sea Island cotton:—

October 12.—Owing to difficulties in obtaining sufficient supply for aeronautical purposes, His Majesty's Government find it necessary in Imperial interests to acquire all Sea Island cotton produced in the West Indies. The Secretary of State for the Colonies has therefore required the Governor to prohibit the exportation of this cotton with a view to its purchase by the Colonial Government on behalf of the Admiralty. While Mr. Long regrets to interfere with the business arrangements of the agricultural community, he feels that he has no alternative to doing so; and he relies with confidence on the patriotic co-operation of the planters. All Sea Island cotton offered will be bought, ginned, baled, and delivered at the port of shipment; and the planters will accordingly be relieved of all difficulties in the provision of tonnage. The question of price has been the subject of most careful consideration, and the following scale has been fixed: Ordinary 36*d.* per lb.; Good ordinary 40*d.* per lb.; Superfine 45*d.* to 50*d.* per lb.; according to quality. Stains will be paid for at the market value on arrival in the United Kingdom. Thirty pence per pound unstained, and 20*d.* stained would be paid on delivery, and the balance after grading has been completed in the United Kingdom. If any profit should be made upon cotton not used yet for British Government purposes, such profit would be divided among all the planters *pro rata*.

TOP-WORKING OF OLD CITRUS TREES.

A pamphlet by R. A. Davis, Chief of the Division of Horticulture, Department of Agriculture, Union of South Africa, published this year, has recently been received by this Department. Its subject is Budding and Grafting of Citrus Trees. This subject has been frequently dealt with in the pages of this Journal, but there are some instructions given as to the top-working of old trees, which may be well worth while reproducing.

It becomes advisable sometimes to change the product of a citrus tree from one variety to another, especially when the citrus tree in question is perhaps only an almost valueless rough lemon, or a bitter orange. The knowledge of how to proceed with this end in view is valuable. If the operation is successfully performed—and there is really no difficulty about it—it saves the expense of uprooting the old tree, and growing or purchasing a young grafted plant, and causes

a crop of the selected variety to be produced in good quantity and in a shorter time than could otherwise be obtained.

In South Africa the budding process has almost entirely superseded grafting in the top-working of full-grown trees. The customary way of proceeding is by one or other of the following methods:—

(1) The entire top of the tree is removed, and buds are inserted into the new shoots which appear.

(2) Buds are inserted into the old wood in suitable places, prior to the removal of the top, then, when it is seen that the buds have taken, the branches are cut off a little above the buds.

Mr. Davis thinks the first plan to be easier and the more satisfactory; the writer of this article has seen it successfully carried out in the West Indies.

If this plan is the one adopted, the first step is to select those branches which are best suited for budding on. It is best to choose three or four strong growing ones at some little distance apart from one another, and well distributed around the trunk, so that the new growths may give a symmetrical form to the tree. All other branches must be removed, and the resulting cuts painted over. The cuts must be made as close to the trunk as possible, leaving no stub. If this is carefully done the bark will completely grow over the wounds in time. Finally the branches selected for budding into are cut off about 12 or 14 inches from their fork with the trunk, the cut surfaces painted over, and the whole tree whitewashed from top to bottom. This last is a most necessary precaution, as it prevents damage to the bark from sun scald, and wards off the attacks of scale insects.

In favourable weather new sprouts will appear in large numbers, and these should all be allowed to grow at first. When it has been decided which of these is most suitable for budding, both with regard to position and vigour of growth, the remainder should gradually be reduced in number until none are left but those selected to carry the buds. Budding is carried out on these in the usual way such as has been often described. As the buds grow they must be pinched back when the shoots are about 18 or 20 inches long, for this not only strengthens the growth, but is a protection against injury from high winds.

The second plan, that of budding into the old wood itself, is carried out in a somewhat similar manner. One objection to this method is that the bark is often so thick that it is most difficult to insert buds. This difficulty may be met by whittling the bark of the spots where the buds are to be inserted, down to a thickness which renders it easier to manipulate. The branches selected should have small sprouts trimmed off, and the buds inserted into them before beheading the tree. As soon as the buds have taken, the tops of the branches may be removed, and the same precautions taken, of painting the cuts, and whitewashing the tree, as in the other method.

Whichever plan is adopted, a tree so treated should, with good treatment be bearing a crop in the third or fourth year after the operation. This top-working of an old citrus tree possesses particular attraction for the owner of perhaps only two or three specimens of almost valueless kinds, in that it is quite possible in this way to obtain several good varieties on one parent stock. The writer of this article has seen growing on one trunk, tangerine oranges, grape-fruit, and a good variety of the ordinary sweet orange, a distinct boon to one who is growing fruit only for family use, and not for commercial purposes. The owner of many trees who desires to market his crop, can, by budding all his trees with the same variety, guarantee uniformity in the product, a point which always conduces to increase in value.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 3 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The subject of recent experiments in the making and storing of farm-yard manure is dealt with in the editorial.

Under Insect Notes on page 330 will be found paper on the subject of white grubs attacking sugar-cane in Porto Rico, and on page 331, a short notice of steps taken to combat locusts in British Guiana.

On page 334, the article under Plant Diseases treats of the bracket fungus pest of lime trees.

A notice of the possible value as food of the fruits of two widely spread plants is to be found on page 333.

The Sex Ratio in Poultry.

At a meeting of the American Philosophical Society held in Philadelphia in April this year, a paper was read by Dr. Raymond Pearl, of the Maine Agricultural Station, describing the factors influencing the sex ratio in poultry. Any information which would make it possible for the poultry raiser to produce a larger number of pullets to lay eggs, in the place of so many cockerels, would be of great value. Dr. Pearl bases his conclusions on the experiments of eight years, and of more than 22,000 individual hens. He concludes that the determination of sex in poultry is due to a definite hereditary tendency. At the same time, in certain physiological circumstances, the operation of this tendency may be modified in such a way as to lead to the production of more females in proportion to the number of males. The chief factor in bringing about this modification is the laying ability of the hens used for breeders. The larger the number of eggs which a hen lays before being utilized as a breeder, the larger will be the proportion of females and the smaller the proportion of males produced from her eggs. Some years ago it was shown by Dr. Pearl that the ability to lay a larger number of eggs than usual in poultry is a definite Mendelian inheritance. As a result of this knowledge it is possible to breed strains of hens in which productivity is a fixed characteristic. The present results, taken in connexion with the earlier ones, show that when poultry is bred along the right lines for increased egg production, a strain will be produced at the same time in which profit-making pullets preponderate over the less profitable cockerels.

The Trade of British Guiana in 1915.

The report of the Comptroller of Customs relating to the trade of the Colony of British Guiana for the year 1916, presents an interesting feature in the employment of very clear diagrams representing the fluctuations for ten years: first, of the total exports and imports and the total trade of the colony; secondly, of the fluctuations of the various duties on wines, spirits, etc.; and thirdly, three showing the fluctuations for twenty years of the amount, total value, and price per ton of the exports of sugar. It is seen at a glance from the first diagram that the trade of British Guiana has steadily risen from its low-water level in 1912 of \$15,267,926 to its high-water-mark of \$26,924,385 in 1916. With regard to the sugar industry, the diagrams show that although 125,949 tons were shipped in 1912—the record for the period represented—as against 101,650 tons shipped in 1916, the total value of the shipments of 1902 was only \$5,001,710, as against \$10,082,005, the value of those of 1916, while in 1902 the average price per ton for sugar was \$41.64 compared with \$99.18 in 1916.

To the ordinary layman, who is not a trained accountant, the presentation of financial facts like these by means of diagrams instead of tables of figures is very welcome, as it enables him easily to grasp the salient points of comparison.

Present Value of Fibres.

The market value of sisal fibre has risen so much in the last two years that there is little wonder that increased interest is being taken in its production in these islands. From Messrs. Ide and Christie's monthly circular concerning the London fibre market, dated August 15, 1917, it appears that the shipment price of Mexican sisal, which was 6½c. per lb. in 1915, had reached 18¼c. per lb. by the end of June 1917, on a steady market.

Another fibre which may in the future, owing to the extension of coco-nut cultivation form a West Indian export of some importance is coir. The present market value of this, according to the same circular referred to above is from £30 to £50 per ton according to its quality. Seeing that this fibre may be considered as only a by-product of the coco-nut industry, the prices seem to be distinctly remunerative.

Machine for Eradicating Weeds by Burning.

In the *Agricultural News*, Vol. XIII, No. 328, notice was taken of a suggestion made in the *Journal of the Royal Horticultural Society*, August 1914, that weeds could be eradicated from walks and paths by the use of an ordinary plumber's blow lamp. At the Show of the Royal Horticultural Society held in Manchester in 1916 Messrs. Stephen Ballard exhibited their Burning Machine made for destroying weeds between rows of black currants, which they claimed they had done, without the use of a hoe. In the front of the machine there is a tank which holds 8 gallons of petroleum sufficient for 1 acre, at a high pressure. Five inverted blow lamps, similar to those used by painters, but larger, are contained in five cannisters behind. These project a flame, intensely hot, on to the soil below, scorching up every weed on the surface, the makers assert. The flame would naturally spread out at the side, and thus damage the currant trees, but a slide can be let down to the soil to avoid this. A smaller machine for destroying the weeds between rows of strawberries was also shown. These machines are only in the experimental stage, and are not on the market, but they may have a great future before them, especially where labour is scarce, though there are obvious drawbacks attaching to their use.

Tanning Possibilities in Antigua.

At a meeting on August 3, 1917, of the Agricultural and Commercial Society, Antigua, Mr. A. E. Collens, the Acting Superintendent of Agriculture, advocated the possibility of successfully tanning leather locally, as a remunerative industry. He pointed out that there was an ample supply for the purpose of hides produced in the Presidency, the value of hides exported in 1915 having been more than £2,000, the local price of hides being 2d. per lb. As regards the supply of tannin, there were many common trees and shrubs in Antigua from which tannin in ample abundance might be obtained. The dried bark of the common mangrove contained 25 to 30 per cent. of tannin; the bark of the mango tree contained from 20 to 30 or even 40 per cent.; the bark

of the common acacia, known locally as 'cossie', contained about 19 per cent., while the pods of the same shrub if the seeds were removed, contained as much as 55 to 60 per cent. Leather has been, and is successfully tanned on a small scale in some of the West Indian islands by using native tanning material, and Mr. Collens thought that it might be well worth while trying it in Antigua.

Cacao Thrips in Grenada.

At a special meeting of the Agricultural Board of Grenada, Mr. F. W. Urich, Entomologist to the Board of Agriculture in Trinidad, gave an informal account of observations he had made during his visit to Grenada of the distribution of cacao thrips. He had visited practically all the localities where thrips gave trouble, and he was pleased to state that conditions were not as bad as he had expected. Attacks were worst on the western and south-western coasts. He advocated the adoption of spraying as the method of control, and explained the methods applied by the Trinidad Board for inducing and helping peasants to spray for thrips. Certain predaceous insects occurring in Trinidad might be usefully imported into Grenada.

Mr. Urich also referred to the possible danger from black ants, which were fairly numerous in all parts of the island.

The Hon. F. R. Harford, in thanking Mr. Urich, remarked that from what the latter had said it appeared that the local Department of Agriculture had been working along correct lines.

Plants Packed in Ice.

Sir Joseph Hooker, in his *Himalayan Journals*, Chapter XXVII, refers to living plants packed in moss, and transported in a frozen state by one of the ice-ships from North America. They were chiefly fruit trees, apples, pears, peaches, currants, and gooseberries, with beautiful plants of the Venus fly-trap (*Dionaea muscipula*). More perfect success never attended an experiment; the plants were vigorous in bud, and the day after they were released from their icy bonds, the leaves sprouted and unfolded.

Mistaken Notions about Botanical Gardens.

Sir Joseph Hooker, in the same book from which the quotation above is taken says, in Chapter I: 'I was rather surprised to find the Botanical Garden looked upon by many of the Indian public, and even by some of the better informed official men, as rather an extravagant establishment, more ornamental than useful. These persons seemed astonished to learn that its name was renowned throughout Europe, and that during the first twenty years especially of Mr. Wallich's superintendence, it had contributed more useful and ornamental tropical plants to the public and private gardens of the world than any establishment before or since.'

Human nature is very much the same everywhere. Similar opinions have been expressed in other places besides India.



INSECT NOTES.

SUGAR-CANE WHITE GRUBS IN PORTO RICO.

It may be remembered that in recent numbers of the *Agricultural News* an account was given of some white grubs injurious to sugar-cane in Porto Rico, as studied by Mr. Eugene G. Smyth of the Insular Experiment Station. In the issue of July 14 mention was made of five species of hard-back beetles (the larvae of which are white grubs), and it was noted that four of these belonged to the genus *Phyllophaga* (or *Lachnosterna*) and one to the genus *Phytalus*. Some of the methods of rearing white grubs were also given. Under the date of July 28 appeared a summary of the life-cycle and habits of the most important of these species, viz. the sugar-cane white grub (*Phyllophaga vandinei*). In the issue of August 11 the natural enemies of these white grubs in Porto Rico were reviewed. The results of the above investigations were published in the *Journal of the Department of Agriculture of Porto Rico*, Vol. I, No. 2, and the details of the habits and life-cycles of the four remaining species have recently appeared in Vol. I, No. 3 of the same journal. The life-histories of these four species are very similar to that of *P. vandinei* given on July 28, so that it is unnecessary to refer to them in detail. The notes on the feeding habits of these species are of interest, however, and are referred to below under each species.

The common white grub (*P. portoricensis*) has a much wider distribution in Porto Rico than *P. vandinei*, occupying at present approximately the eastern two-thirds of the island. It is not, however, very prominent as a pest of sugar-cane, but has been found to be particularly injurious in the grub stage to coffee groves and pine-apple plantations. The damage to coffee groves is due to the fact that coffee is grown under certain forest shade trees, to the leaves of which the beetles are very partial. Mr. Smyth states that after feeding, the beetles descend to the coffee trees beneath the larger shade trees, burrow down into the soil in great numbers at their bases, and there deposit their eggs. 'The beetles do not feed upon the coffee foliage, but that fact does not, however, prevent the larvae from attacking the coffee roots.' As in the case of *P. vandinei*, the adults of this species, *P. portoricensis*, are sometimes very destructive to the foliage of banana, casuarina, and flamboyant; they also feed on the leaves of many other trees and plants, including Indian almond, coco-nut, breadfruit, bamboo, avocado, cacao, and mango.

There is one strange characteristic which has been noticed in connexion with the feeding habits of this species, namely, that large numbers of the adults are often found in the soil at the bases of trees and weeds upon which they do not feed, such as coffee or young citrus trees, while they are seldom found at the bases of certain trees to the foliage of which they are very partial, such as banana and coco-nut trees. This habit is explained by the fact that the beetles before retiring to the soil for the day after feeding, take flight and

alight upon small trees or weeds, or upon any upright object affording them a good foot purchase, down which they crawl to the soil and enter it. Their holes are thus often found around the bases of posts and dead weeds. Banana trees are too smooth to offer good foot purchase, hence they are not settled upon; and coco-nut palms are provided with a heavy abutment of closely interwoven roots at the base that prevent the beetles from reaching the ground from them.'

The south coast white grub (*P. guanicana*) is so called from its occurrence in the Guanica District of the south-west coast of Porto Rico, and so far it seems to be confined to that locality. It is not of much importance as a sugar-cane pest in comparison with *P. vandinei*, which also occurs in the same district. Collections of beetles made from March to June 1914 in cane fields showed that *P. guanicana* adults amounted to less than 1 per cent. of the total, the remainder being adults of *P. vandinei*. Outside of cane-fields however, this species is just as abundant as *P. vandinei* in the spring, and it was observed that this species feeds mainly upon trees and plants not frequented by the larger species, *P. vandinei*; for instance, the adults of *P. guanicana* are found abundant on leaves of *Lantana camara*, the black sage (*Cordia cylindrostachya*), and the ucar tree (*Bucida buceras*)—known in Antigua as Whitewood, and in Barbados as White Cedar—which are all upland species growing along fences or scattered through pasture land. They also feed on the leaves of flamboyant, casuarina, tamarind, and guava, among others. It is thought that the grub of this species may be a sod-frequenter, preferring dry upland soils, and that it has not yet got into the cane fields to any extent.

The citrus white grub (*P. citri*) gets its name from the fact that, although it has a large variety of food-plants, it is primarily a pest of citrus trees. The beetles feed on the leaves of grape fruit and orange among other food-plants, and the grubs injure the citrus roots, the damage being more evident in the case of young trees than of old. This seems to be the most widely distributed species of *Phyllophaga* in Porto Rico. The citrus groves in the north and west of the island suffer considerable damage from this pest, and even such measures as spraying or hand collecting appear to give only temporary relief. This species attacks a large variety of trees and plants, and must be considered an important general crop pest.

The little brown may-beetle (*Phytalus insularis*) is by far the smallest of the five Porto Rican species of *Melolonthids*. It is probably generally distributed over the western two-thirds of the island, but is not of much importance as a cane pest. Its life-cycle is similar to those of *Phyllophaga*, and occupies just about a year. Its range of food-plants seems to be rather small as compared with the other species, since the beetles are only recorded as feeding on pigweed (*Amaranthus* spp.), Para grass (*Panicum barbinode*), and *Lantana involucrata*, to any great extent.

NATURAL ENEMIES.

The insect and fungus enemies of the above four species of white grubs, so far as they have been observed, are identical with those given for *P. vandinei* in the *Agricultural News* for August 11, 1917. The predaceous wireworm (*Pyrophorus luminosus*) is the most important enemy of the grubs of *P. portoricensis* and *P. citri*, but has not been observed in relation to *P. guanicana* or *P. insularis*. The parasitic Tachinid fly (*Cryptomeigenia aurifacies*) is useful against the adults of *P. portoricensis*, and it is thought that it may attack *P. citri*. Another Tachinid is known to be a useful parasite of *P. vandinei*, but the other hosts of this fly have not as yet been exactly determined.

The green muscardine fungus (*Metarrhizium anisopliae*) attacks the adults of *P. portoricensis*, *P. guanicana*, and *P. citri* in the experimental cages, and some of the immature stages of these species also became infected with this fungus.

A large percentage of grubs in the breeding cages were attacked and killed by a bacterial disease which is considered to be identical with *Micrococcus nigrofaciens*. But at no time were grubs, collected in the cane fields or elsewhere out of doors, found affected by this disease. Whether the disease is ever fatal to grubs under field conditions in Porto Rico is a point that needs further investigation.

J.C.H.

WARBLE FLIES.

In the course of the article on Warble Flies in the last number of the *Agricultural News*, October 6, 1917, reference was made to the discovery that the eggs of these pests are not laid in the hides of cattle, but are fastened to the animal's hairs, mainly those on the legs. It was also noted that the life-history, as modified by this discovery, was given by C. V. Riley in 1892. Since preparing the above article the writer has come across a note in the last number of the *Journal of Economic Entomology* for August 1917, which throws some further light on the subject and may be of interest in this connexion. This note, which is reproduced below, is contributed from Agassiz, British Columbia, by Hadwen, who has made many valuable observations and experiments within recent years in connexion with the life-histories of warble flies in Canada:—

'Credit to whom credit is due. On a recent visit to the Bureau of Entomology, through the courtesy of Dr. L. O. Howard, the following facts were ascertained.

'The anonymous person mentioned by C. V. Riley in his article on the Ox Bot of the United States, 1892, was Mr. F. G. Schaupp, of Shovel Mount, Texas, a special field agent of the United States Department of Agriculture. Dr. Howard kindly showed me a number of letters from Mr. Schaupp, dated March 1892, proving conclusively that he was the experimenter, and that Riley merely recorded his observations. The anonymity of that time was on account of personal matters relating to Mr. Schaupp. The principal reason for my writing this note is on account of a somewhat severe criticism I made of the late Professor Riley in *Parasitology*, 1915, saying that his records were not his own, and also to give credit to Mr. Schaupp for his excellent and valuable experiments on the life-history of *H. lineatum*. Seeing that Professor Riley is dead, and that Mr. Schaupp was buried at San Antonio on November 10, 1903, there seems to be no further necessity for keeping his name secret. Mr. Schaupp was the first President of the Brooklyn Entomological Society, and is well known for his work in Entomology, especially on the Coleoptera. In conclusion it might be mentioned that Mr. Schaupp was the first discoverer of the eggs of *H. lineatum*, and that he also made some valuable notes on the method of oviposition; therefore I think that in future his name should be mentioned in all articles relating to past experiments on warble-flies.'

J.C.H.

LOCUSTS IN BRITISH GUIANA.

The South American locust (*Schistocerca paranensis*) is a terrible scourge when it invades any agricultural district. They are voracious in the extreme, and their powers of destroying vegetation are unparalleled. Produced in countless swarms they cause immense damage from time to time

to cultivated crops in the Venezuelan States which border the Gulf of Paria, and they have been known to invade Trinidad in smaller hosts. One curious thing about them is that they discriminate in the choice they make of plants to devour, devoting unfortunately most of their attention to crops most largely grown in the tropics. In a district visited by swarms of this insect, coco-nut and banana trees are stripped bare of their foliage; cassava, corn, and sugarcane are eaten to the ground; orange trees are badly damaged; and although cacao trees are usually left alone, when other food is scarce cacao flowers and young pods, and cacao beans when drying are also attacked. The 'bois immortel' (*Erythrina umbrosa*) planted as a shade for cacao trees is always completely stripped of leaves when the locusts invade a district.

It is no wonder that the Board of Agriculture in British Guiana, in view of the invasion of certain districts of the colony by swarms of these pests in the last month, has issued an Order putting in force stringent measures for dealing with the attack.

This Order, dated September 17, 1917, first defines certain districts as infected areas within the meaning of the local Plant Diseases and Pests (Prevention) Ordinance, 1914.

The Order then gives a short description of mature winged insects, of the immature locusts, or 'hoppers', in the wingless stages, and of the eggs, and where they are laid.

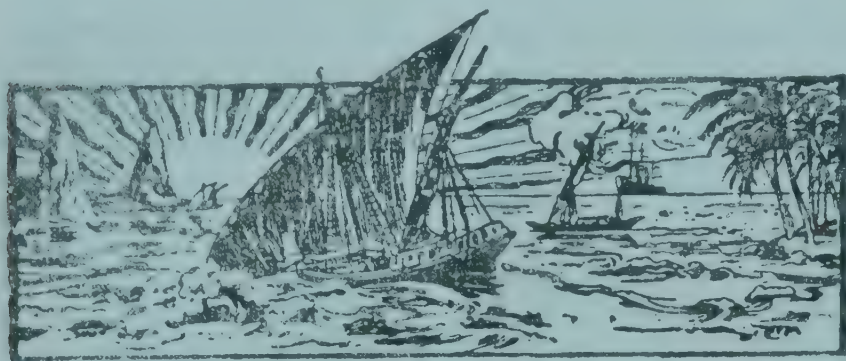
The following directions are then laid down:—

- (1) *Eggs*.—The eggs as previously described must be sought for, dug up and destroyed.
- (2) *Hoppers*.—The hoppers must be destroyed by:—
 - (a) surrounding them with dry foliage or brushwood sprinkled with kerosene oil, and burning them; or by
 - (b) driving them into a trench 2 feet wide and 3 feet deep into which kerosene oil has been poured, the kerosene being lighted after the hoppers are in the trench; or by
 - (c) driving them into drainage or other trenches which contain water on whose surface kerosene has been poured; or by
 - (d) driving them on to canvas sheets, bags, galvanized iron sheets, banana leaves, young troolie palm leaves, or other suitable surfaces which have recently been smeared with coal tar or other thick and sticky liquid.
- (3) *Vegetation*.—Vegetation in the immediate line of advance of the hoppers must be poisoned by spraying or dusting it with one of the following arsenicals:—
 - (a) Arsenate of lead paste 4 lb.
Water 50 gallons.
 - (b) A mixture of 1 lb. of Paris green and 5 lb. of slaked lime.

Certain officers of the Department of Science and Agriculture are empowered to enter any lands within the infected area for the purpose of the destruction of any locusts, their eggs, and hoppers, which may be thereon, or for the purpose of examination or enquiry into the presence of such locusts, eggs, and hoppers, and into the steps which may have been taken by the occupier of such land for the destruction of the pests.

In conclusion, the order prescribes the liability to a penalty not exceeding \$100, of any person who obstructs such authorized officers in the execution of their duties or who fails to comply with the Order.

It is hoped that these strong measures will serve to control the locust attacks, and to prevent their further spread.



GLEANINGS.

The Province of Quebec is the chief producer in Canada of maple sugar and syrup, says the *Journal of the Royal Society of Arts*, the total annual value of those two products being about £400,000. Of the total yield the United States took 99 per cent. of the sugar and 50 per cent. of the syrup.

The *Queensland Agricultural Journal*, July 1917, reports that Mr. C. Ross, Instructor in Fruit Culture, says that in Queensland a deep rooted system for citrus and many other fruit trees gives the best results, and surface roots should be discouraged by continuous cultivation. Surface roots are too susceptible to every climatic change.

The great secret of canning lies in complete sterilization. The micro-organisms which are present in the air and in all substances, and are the causes of rotting or decomposition, must first be destroyed by heat, and then completely excluded by sealing, so that they cannot renew their attempts to destroy the food. (*Bulletin No. 298*, Department of Agriculture, Commonwealth of Pennsylvania.)

Every year the people of Porto Rico consume over three times as much wood as the forests of the island produce. Great quantities of timber are cut or burned by the squatter to make a clearing which is abandoned after a few years, and becomes a mere waste. The charcoal burner is also destroying the young growth needed to keep up the forest. (*Bulletin No. 354*, United States Department of Agriculture.)

The *Wealth of India*, for June 1917, says that up to the present time India has found it impossible to compete with the cotton exports from Japan, even though Japan spins these goods out of Indian cotton. During recent years the volume of Japanese cotton imports into India has been steadily rising, and Japan has been steadily driving Indian yarn and piece goods out of the China market. It is uncertain whether the increase in the import duty on cotton goods will help the Indian industry to oust Japanese cotton from India.

In a report of a special committee of the Board of Agriculture of Trinidad are to be found valuable suggestions for the encouragement of the rice industry in that island. It is recommended that the Department of Agriculture should continue its trials of varieties of imported rice, especially those from British Guiana, India, and Louisiana, but that no general distribution of the seed of such varieties be made until it has been shown that they are suited to local conditions, and give better returns than those already grown. (*Bulletin of the Department of Agriculture of Trinidad and Tobago*, Vol. XVI, Part 1.)

At a meeting of the Horticultural Club, Port-of-Spain, Trinidad, September 13, Mr. Broadway said that he had learnt that a chief difficulty in rearing roses in Trinidad was too much moisture. He successfully overcame that difficulty by digging trenches about 3 feet deep and as broad as he wished, filling them up to 1 foot with large and small stones, and the remaining 2 feet with about equal proportions of soil and manure. As the result of this he succeeded in growing roses which were all that could be desired from the point of view of quantity and quality of blooms produced. (*The Port-of-Spain Gazette*, September 14, 1917.)

From an article in the *Field*, September 1, 1917, we learn that the sugar planters and sugar-mill owners in Natal are having their share of the economic trials of the present time. Supplies for all chemicals required for sugar-making are restricted, and their prices doubled and trebled, while renewals and replacements of machinery a very important item in all sugar mills, are in many cases unobtainable, so that a breakdown may involve a complete stoppage for an indefinite period. The extent of the unexecuted orders for plant is indicated by the fact that one group of millowners gave evidence at an inquiry that they had orders to the value of £100,000 still unfilled.

India and the Crown Colonies concerned now have to consider a scheme to provide aided colonization for East Indians to British Guiana, Trinidad, Jamaica, and Fiji, to replace the system of indentured labour which has been so strongly objected to by Indian educated opinion. The suggestion made in some quarters that the existing temporary prohibition of Indian emigration should be made permanent is entirely unreasonable. It would be unjust not only to the colonies concerned, two at least of which are almost entirely dependent for their prosperity upon labour supply from India, but also to the thrifty peasant class of India, as well as to their countrymen already settled in the colonies, and therefore directly concerned in their prosperity. (*The Times Trade Supplement*, September 1917.)

A meeting of the United British Oilfields of Trinidad Company was held in London on September 4. Mr. H. N. Benjamin, who presided, gave the following statistics of the production for the year: 43,826 tons had been the output, an increase of some 2,000 tons over that for 1915; while, for the first half of the current year, approximately 34,000 tons had been produced. This increase was explained by the fact that early in 1917 they had obtained initial production from several wells, but they had been unable to make the increase permanent. The war had shown a very considerable demand for oil, and the many uses to which it was put pointed to others of a more peaceful nature which would be available to them in due course. (*The Morning Post*, September 5, 1917.)

The *London Globe* dated September 6, 1917, in dealing with the pine-apple industry, says that while pine-apples have long been grown in the warmer parts of South Africa for local consumption, nothing has yet been done in the way of starting a tinned pine apple industry on the spot. In Johannesburg there is actually a considerable sale of tinned pine-apples imported all the way from Hawaii. The British Empire Producers' Organization learns, however, that a pine-apple canning establishment is at last being set up in South Africa, and this should be the forerunner of many others, and of a big export trade. The Straits Settlements is the only tropical British possession which has as yet developed a big industry in the tinned product, exporting over £300,000 worth annually.

UTILIZATION OF WASTE WOOD.

Some years ago it was pointed out in an article published in the *Bulletin of the Imperial Institute* (1909, 7, 73) that the distillation of wood is an industry that might well be extended in the British Empire. At that time the industry was in operation in Canada and Australia, and its possibilities in Natal and India were suggested. Wood distillation at the present time is being carried on at a number of places in the United Kingdom, notably at the Government Works in the Forest of Dean, Gloucestershire; but, as is stated in the *Bulletin* for October-December 1916, this country is largely dependent on foreign countries for its supplies of wood distillation products, which include acetate of lime, acetic acid, acetone, methyl alcohol, and wood tar; and tables are given in the publication last quoted, showing the imports of these products into the United Kingdom during the last three years. From these tables it is seen that the only country of the Empire which supplies the United Kingdom with any of these products is Canada.

In view of the fact that acetone is at present required in large quantities for the manufacture of propellant explosives, the dependence on foreign countries for these supplies is rightly regarded as unsatisfactory. It is pointed out, however, in the *Bulletin* last mentioned, that during the last year or two, the question of the destructive distillation of wood and other vegetable substances has been taken up in certain British countries. (*Agricultural News*, Vol. XVI, No. 388, p. 71.) For example, the possibility of utilizing the wattle wood which accumulates in connexion with the wattle-bark industry in the East Africa Protectorate, has also been considered, and a consignment of this wood, as well as of olive wood, which is used as fuel in the Protectorate, was sent to the Imperial Institute early last year in order that distillation trials might be carried out. A table summarizing the detailed results shows that these woods yielded the following products:—

	Black Wattle, 1 ton.	Olive wood, 1 ton.
Acetic acid	4.7 per cent.	3.0 per cent.
Equivalent to acetate of lime	6.2 " "	4.0 " "
Methyl alcohol	1.2 " "	1.6 " "
Tar, separated	6.0 " "	7.4 " "
Charcoal	27 " "	29 " "

From a comparison of the probable yield and value of the various products obtainable from a ton of each of the above woods, with the actual yields and values of the products obtained at a modern factory in the United Kingdom distilling oak wood, it appears that, on the basis of the prices obtainable in June 1914, which may be regarded as normal, both wattle wood and olive wood show a slight advantage over oak wood, and should therefore be at least as profitable to distil. And it is argued that as large quantities of acetate of lime and wood spirit are used in the United Kingdom, considerable quantities being imported from the United States and elsewhere, there would be no difficulty about finding a market in the United Kingdom for these products from East Africa, if a wood distillation industry were started in that Protectorate.

It would appear from the foregoing that the possibilities for the development of a new and remunerative industry in the East Africa Protectorate are considerable.

We might add that increased attention is being given to sisal cultivation in some parts of the West Indies, and it would not be improbable for the fermentation of sisal waste as an industry to be undertaken. Results obtained from the fermentation of this material in British East Africa were published in the number of this Journal above quoted.

TWO POSSIBLE SUBSTITUTES FOR SQUASHES.

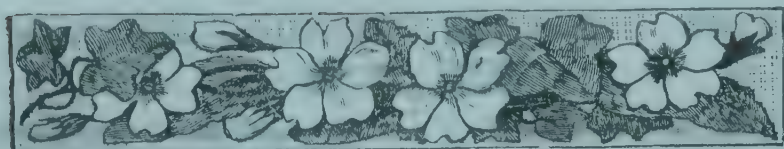
The natural order of plants to which the name Cucurbitaceae is given contains many which are grown in almost every country of the world as affording palatable, wholesome succulent fruits or vegetables, such as pumpkins and squashes, cucumbers and melons. On the other hand, some of the genera of the order, such as Bryonia and Colocynthis, possess poisonous qualities. There are, however, some genera the fruits of which, though valued in certain places as articles of food, are either generally unknown or unutilized for that purpose.

Among these is *Momordica Charantia*, known in the West Indies under various names, 'balsam apple' in some islands, 'maiden apple' in others. This plant is a rapid growing annual creeper, very ornamental both in foliage and flower, and its bright yellow fruits with their crimson seeds are, perhaps, its most ornamental feature. The only use made of the fruit in the West Indies, as far as the writer is aware, is that they are sometimes pickled when green. In the eastern tropics, however, where the plant is indigenous, it is regularly cultivated, and its fruit used for food. From a paper in the *Philippine Agriculturist and Forester*, February 1917, it appears that superior varieties are grown in those islands, the ripe fruit of which is from 6 to 8 inches in length, and white instead of being bright yellow, and which finds ready sale in the local markets. These fruits are generally used, we learn from the same source, 'for salads and in a curry with fish. In the Philippines the leaves are used also in curry with fish or meat.'

We regret that we have no information as to the stage at which the fruits are so used, as some of our readers might like to experiment in this direction with a view to adding another item to their list of edible delicacies. It ought to be remembered, however, that the seeds and their sticky red covering have a disagreeable taste, and they should be removed before making experiments with the outer part. The probability is that the fruit is made use of before it is ripe, as is the case with cucumbers.

Another plant of the same order, which has also been introduced into the West Indies from the eastern tropics, is *Luffa cylindrica*, known in these islands as 'Strainer vine'. When the gourd-like fruits of this climber are fully ripe they contain a mass of netted fibre, which is often used as a bath sponge, or as a wide-meshed strainer; hence the local name. But like the *Momordica*, the fruits of the *Luffa* are used as a vegetable in the east. For this purpose they must be picked when young, because the fibrous internal structure begins to develop as the fruit matures, and it then becomes quite uneatable. In the Philippines, where it is cultivated in market gardens quite extensively, the green fruit is cooked with meat, and used in making soup. A distinguished botanist, Dr Roxburgh, has said that when 'peeled, boiled, and dressed with butter, pepper, and salt, this vegetable fruit is only a little inferior to green peas.' Perhaps the Doctor's gastronomic discernment was not quite equal to his botanic knowledge, but the fact that the fruit of the *Luffa* is recognized in many places as a pleasant and wholesome article of food, makes it deserving of a trial in this way on West Indian tables.

A sisal growers' association has been formed in the Cayman Islands, and loans are to be made from local funds to enable the people, who are extremely poor, to prepare their lands, and to purchase suckers for growing this fibre-yielding plant. (*The Field*, for August 18, 1917.)



PLANT DISEASES.

The following report of the Mycologist of the Department, Mr. W. Nowell, D. I. C., on a recent visit to Dominica, has been printed in the Dominica *Official Gazette*, August 27, 1917, and is here reproduced:—

BRACKET FUNGI OF LIME TREES.

The fungi found occupying the stems and branches of the trees are to be regarded, according to my observations, as obtaining a foothold in the first place only on dead branches, and then functioning largely as saprophytes, and at most, in a certain type of cases, as weak parasites principally affecting the wood. The bark of dead or dying branches is usually found to be infected with smaller fungi of which *Nectria* and *Stilbum* spp. are the most noticeable.

The damage done, however, arises almost entirely from the destruction of the woody framework of the tree, and not from any direct attack on the active tissues of the bark and young wood. The destruction is probably largely due to the mycelium of the bracket fungi in question.

They are able to establish themselves on any dead stub left from the failure of a branch or from careless pruning, no matter how healthy the tree may be. But the subsequent progress of the infestation depends on the condition of the adjoining parts. In vigorous trees the decay is arrested when the living branch is reached. Even the wood shows considerable powers of resistance. It rots slowly where it is exposed, and, unless the wound is trimmed so as to permit the bark to grow over it, there is produced in time an unsightly cavity, but the process is no more than goes on in any tree not carefully trimmed, and unless the wound is a particularly large one, it does not produce serious results for a long time.

The less vigorous the tree, the less resistant is its wood to decay, and the extreme cases of fungus infestation are to be seen in fields where, after the trees have attained to a good development from the original humus content of the soil, or from the practice of a good system of manuring, the fertility of the soil has then been allowed to run out, and the trees are no longer sufficiently nourished. The policy of substituting sulphate of ammonia, without any packing of humus-building material, for pen manure, mulch, and other organic manures is clearly seen in some cases to have produced this effect. In other cases it has come about from complete neglect of manuring, combined with careless treatment of the soil in the way of ignoring drainage, and, in some instances, packing it by the constant pasturing of cattle. As starvation takes effect one or more sections of the trees begin to die back branch by branch, and not only the dead, but the failing branches become infested with fungi. The removal of the dead branches does little to arrest the process; the wood of the next larger branch or stem is usually already infected, and offers little resistance to the progress of decay. In the course of time the base of the tree is reached by way of the stem or stems involved, and permanent restoration is no longer possible. Growth is usually continued by suckers put out around the base, which may attain to a considerable size, and give the tree a renewed lease of life. In time the rotting of the central part of the crown, due to the downward extension of decay from the

original stem, destroys the connexion between the suckers, depriving them of mechanical support, and leaving them with exposed wood on their inner sides in the neighbourhood of soil level. They are rarely able to establish themselves as permanent stems, and sooner or later, from the weight of the crop or the force of the wind, they fall outward, or are broken off. The process of failure thus outlined is a gradual one, commonly extending over some years, and seems in consequence to be usually regarded with indifference, until the end result appears. There is, even in the worst cases of this type seen in Dominica, no question of any quick destruction of trees, such as is produced by an active parasite like *Rosellinia*.

It has been further noted in cases where lime trees have been grown on poorish land, and without manure, and have in consequence grown slowly from the beginning, that although they may develop dead branches in the course of time, their wood does not appear to be nearly so susceptible of decay as is the case with trees which have grown more quickly. The lime will often live, and remain healthy for a long time under hard conditions, but seems to be particularly liable to suffer as a result of irregularities in the conditions. This should be kept in mind in constructing a policy for the distribution of the manure available for an estate.

The remedial and preventive measures which should be adopted are clearly indicated. In fields where die-back is in evidence, or where small and scanty foliage shows that the trees are lacking in vigour, the first essential is to restore the fertility of the soil. If it has become consolidated, or is covered with a firm sod it should be lightly forked; as much organic material as can be obtained in the shape of pen manure, mulch, cotton-seed meal, lime seeds, and sheep manure should be applied; the weed growth, if rank, may be cutlashed and used as mulch towards the end of the wet season. Leguminous cover crops may be grown if there is light enough for their development.

At the same time the work of clearing the trees of dead and sickly branches should begin. Men who have received elementary instruction in this work should be kept to it as much as possible, and it will be necessary that a responsible person who understands the lines of action should direct it. It is proposed to issue shortly from this Office a pamphlet setting out the main principles of tree surgery, such as are here involved. In outline they are as follows:—

(a) To cut back to a living branch or stem which seems likely to survive, and to have vigour enough to cover the wound. The most frequent mistake made lies in not cutting back far enough; the upper dead portion of a branch is removed, a sickly lower section being left because it still has green leaves, or carries a few limes. This in turn dies back, and the process is repeated. If at the first essay the cut is made behind the failing section, there is a prospect of stopping the die-back in one operation.

(b) To trim the wound so that it is as far as possible flush with the surface of the branch or stem remaining. Plain saw cuts rarely accomplish this, and should be trimmed with a hatchet, a chisel, or a cutlass into conformity. This usually means a bigger wound, but it is better to expose more surface which will easily cover than to leave a projecting lip which is out of the circulation of the sap, and will probably decay.

(c) Protect the exposed wound from ants, wood-ants, and fungi, until the bark has time to cover it. Asphalt paint, resin petroleum, resin wash, carbolineum, or ordinary white lead paint may be used for this purpose. The last mentioned is perhaps the least satisfactory. Coal tar

should not be used on citrus trees; some consistent of it appears to penetrate the bark, and check the growth of the cambium. Cavities which cannot be cut out should be cleaned, dressed with carbolineum, and filled with cement to make a level surface for the bark to cover.

As already indicated, when decay has invaded the base of the tree a permanent repair is no longer possible. The life of the remaining parts may, however, be much prolonged in many cases, if it is considered worth while, by cleaning and smoothing off the wood which remains sound, and coating it with a preservative. As the soil moisture greatly hastens decay in this region, it is usually advisable to draw away the earth from the crown, and keep its neighbourhood clear of sheltering weeds.

This report will be concluded in our next issue.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of August 1917:—

In times of peace and prosperity the month of August is always a period of slackness in the produce markets, as well as in all other industries. Last year, however, the holiday season was scarcely recognized, depression both in trade and manufactures being general, but after the lapse of twelve strenuous months, the necessity of some change from work weariness has been felt, and though there has been a holiday air among the people, the general tone of the produce markets continues that of depression, with very few changes either in supply or demand from our record for July. The following are the chief items of interest.

GINGER.

Quite at the beginning of the month ginger was represented at auction by 300 bags of fair washed rough Cochin, all of which were bought in at 72s. per cwt; 128 bags of rough brown Calicut were also bought in at 70s. Good limed Japanese, of which 336 bags were offered, were held at 45s., and for 100 bags of fair Sierra Leone 60s. was asked. A fortnight later the sales and prices of ginger were as follows: good common Jamaica 87s. 6d. to 92s. 6d., and medium to good 95s. to 100s. Limed washed rough Cochin fetched 65s., and brown rough Calicut was bought in at 72s. At the last auction on the 29th there was a very quiet market, when 300 bags of washed rough Cochin were bought in at 70s., 178 packages of brown rough Calicut at 65s., and 152 bags of limed Japanese at 45s. per cwt.

SARSAPARILLA.

The offerings of sarsaparilla at auction on the 23rd of the month were as follows: grey Jamaica 31 bales, Mexican 25, and native Jamaica 21. None of the grey Jamaica was disposed of, but it was rumoured that the price demanded was 3s. 9d. Of the native Jamaica 14 bales found purchasers, 2s. being paid for dull yellow, and 2s. 2d. to 2s. 3d. for dull red to fair mixed. Five bales of the Mexican were also sold, fetching 1s. 5d. per lb.

CITRIC ACID, PIMENTO, LIME JUICE, LIME OIL, TAMARINDS, CASHEW NUTS, KOLA, AND NUTMEGS.

At the opening of the month citric acid was quoted at 3s. 3d. to 3s. 4d. per lb. At the middle of the month, owing to large arrivals, it became easier, and at the close it had declined to 3s. 2½d. to 3s. 3d. Pimento was represented at the first auction, on the 2nd of the month by 253 bags, all of which were bought in at from 3½d. to 3¾d. per lb. At the last auction on the 30th of the month 150 bags of fair quality were brought forward, but were all bought in at 3s. ¾d. per lb. Lime oil was reported in the middle of the month to be somewhat easier, West Indian distilled being obtainable at 7s. 6d. per lb. Of lime juice large stocks are reported as being on hand, 3s. per gallon being asked for good Jamaica. New crop Barbados tamarinds were offered at the beginning of the month at 37s. 6d. per cwt. in bond. A fortnight later a scarcity was reported, and 40s. per cwt. in bond was demanded. Cashew nuts were in abundance at the auction on the 23rd of the month, 63 packages being offered, and 45 sold: 70s. per cwt. was the price demanded for the remainder. At the same auction 3 packages of West Indian kola were offered, and one sold at 6d. per lb. for fair West Indian halves. At the last auction of the month, namely the 30th, 460 packages of nutmegs from Java were offered, and sold at an increase of from 1d. to 1½d. per lb. on previous rates. At the same auction 150 bags of pimento were offered, but were all bought in at 3¾d. per lb.

DEPARTMENT NEWS.

The Imperial Commissioner of Agriculture for the West Indies returned to Barbados on Wednesday, October 17, 1917, from an official visit to St. Vincent.

Mr. W. Nowell, D.I.C., Mycologist on the Staff of the Imperial Department of Agriculture, left Barbados for St. Vincent on Wednesday, October 17, 1917, for the purpose of investigating diseases of cotton and other plants. Mr. Nowell is expected to spend four weeks in that island.

A special appropriation has been made by the Advisory Committee of the Department for Scientific and Industrial Research, to enable the Imperial Commissioner of Agriculture to retain the services of Mr. S. C. Harland, B. Sc., Assistant Agricultural Superintendent, St. Vincent, for the purpose of continuing special investigations in relation to cotton.

It is stated that the leading Swiss hydro-electrical works are now in a position to manufacture alcohol on a large scale by the treatment of calcium carbide with hydrogen derived from the electrolytic decomposition of water. These works are so favourably situated as regards abundant water power that they will be able to sell pure industrial alcohol at \$108.04 per metric ton of 2,204.6 lb., and a spirit of second quality at \$102.68 per metric ton—far less than the Swiss Confederation now pays for imported spirit. (*The Perfumery and Essential Oil Record*, August 1917.)

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
September 6, 1917.

ARROWROOT—5½d. to 6½d.
BALATA—Block, no quotations; Sheet, 3/9.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
COTTON—Fully Fine, no quotations; Floridas, no quotations; West Indian Sea Island, no quotations.
FRUIT—Bananas, no quotations; Oranges, no quotations.
FUSTIC—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
ISINGLASS—No quotations.
LIME JUICE—Raw, 2/6 to 2/9; concentrated, £30; Otto of lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—2/- to 2/3 per lb.
NUTMEGS—1s.
PIMENTO—3½d. to 3¾d. per lb.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.
RUM—Jamaica, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., September 28, 1917.

CACAO—Caracas, 12½c. to 13½c.; Grenada, 12½c. to 12¾c.; Trinidad, 12½c. to 13c.; Jamaica, 10½c. to 10¾c.
COCO-NUTS—Jamaica and Trinidad selects, \$41.00 to \$42.00; culls, \$26.00 to \$28.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 60c.; Antigua and Barbados, 55c. to 60c.; St. Thomas and St. Kitts, 50c. to 55c. per lb.
GRAPE FRUIT—Jamaica, \$2.00 to \$4.50 per box.
LIMES—\$4.75 to \$5.75 per brl.
MACE—38c. to 42c. per lb.
NUTMEGS—20c. to 21c.
ORANGES—\$2.50 to \$3.25.
PIMENTO—5½c. to 5¾c. per lb.
SUGAR—Centrifugals, 96°, 6.90c; Muscovados, 89°, 6.64c.; Molasses, 89°, 5.88c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., August 24, 1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.50 to \$13.00.
COCO-NUT OIL—\$1.25 per Imperial gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—No quotations.
DHAL—No quotations.
ONIONS—\$7.00 per 100 lb.
PEAS, SPLIT—\$11.00 to \$12.00 per bag.
POTATOES—English, \$5.00 per 100 lb.
RICE—Yellow, \$10.00 to \$10.75; White, \$7.00 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 2, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$10.50 to \$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MANURES—Nitrate of soda, no quotations; Cacao manure, no quotations; Sulphate of ammonia, no quotations.
MOLASSES—No quotations.
ONIONS—\$9.00.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$8.25 to \$11.20
RICE—Ballam, \$10.50 to \$11.20 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$6.50.

British Guiana.—Messrs. WIETING & RICHTER; Messrs. SANDBACH, PARKER & Co.

ARTICLES.	Messrs. WIETING & RICHTER.	Messrs. SANDBACH, PARKER & Co.
ARROWROOT—St. Vincent	NO QUOTATIONS.	NO QUOTATIONS.
BALATA—Venezuela block Demerara sheet		
CACAO—Native		
CASSAVA—		
CASSAVA STARCH—		
COCO-NUTS—		
COFFEE—Creole Jamaica and Rio Liberian		
DHAL— Green Dhal		
EDDOES—		
MOLASSES—Yellow		
ONIONS—Teneriffe Madeira		
PEAS—Split Marseilles		
PLANTAINS—		
POTATOES—Nova Scotia Lisbon		
POTATOES—Sweet, B'bados		
RICE—Ballam Creole		
TANNIAS—		
YAMS—White Buck		
SUGAR—Dark crystals Yellow White Molasses		
TIMBER—GREENHEART Wallaba shingles ,, Cordwood		



AGRICULTURAL NEWS

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Infertility under Trees.

MANY trees in the tropics, notably the tamarind and the West Indian evergreen (*Ficus nitida*), are well known to cause infertility around them. It is quite impossible to grow hardy grasses around a tamarind even at some distance away from the spread of its branches. Bamboos also are almost as bad in this particular. Anyone will notice that a bamboo clump stands with bare ground for some distance around it.

One reason given for this is that it is on account of the shade. This does not seem valid, (1) because those in 'grass soil' were vigorous. The addition of

the infertility spreads further away from the tree than its permanent shade, and (2) because many trees giving just as dense a shade do not seem to affect the soil in the same way. Another point to be considered is that even after such trees, as a tamarind for instance, have been uprooted and removed, the soil of the spot still requires much care before its fertility under ordinary crop is restored. Shade therefore, that is the undue interception of the rays of the sun on the soil, is not a sufficient explanation of the problem.

The question as to what are the real causes of this infertility produced by certain trees has been the subject of investigation by the Agricultural Research Institute, Pusa, India, the results of which have been set forth in a paper by Mr. Jatindra Nath Sen in the *Agricultural Journal of India*, for July 1917.

A sample of soil one foot deep was taken from under a tamarind tree. The soil of the upper six inches and that of the lower six inches was placed separately in cultivation jars, after all parts of the tamarind roots had been removed. A sample of soil from a grass plot at a distance was similarly treated as a control. Seeds of maize were then sown in all the jars. In order to test whether fallen leaves or parts of the tree were responsible for the infertility, tamarind leaves and portions of roots were added to the soil in some jars of each set.

The moisture of the soil in the jars was kept at 20 per cent. in every case.

At the end of two months it was apparent that

all the plants in 'tamarind soil' were very sickly, while those in 'grass soil' were vigorous. The addition of

the tamarind leaves to the soil did not seem to have had any influence one way or the other on the growth of the plants. It was thus plain that the tamarind soil contained something harmful to the growth of the crop.

The soil was therefore analysed and was proved to contain an excess of soluble salts known to possess a harmful effect on vegetation when present in such amounts.

Other observations confirmed this reasoning. A row of bamboos was cut down, and the land brought under cultivation, but wherever the clumps of bamboo had stood the soil was infertile, and the surface in some places was covered with saline deposits.

A sample of soil was taken from a spot where a tamarind tree had been cut down. The soil was analysed at different depths with the result that sodium sulphate was found in large percentage, but decreasing with the depth.

As has been noticed above, some trees are comparatively harmless to vegetation growing beneath them. It seemed probable, therefore, that the roots of some trees might contain more alkalies than others. An analysis accordingly was made of the roots of bamboo, which acts deleteriously on the soil in its neighbourhood, and of *Dalbergia sissoo*, which was one of the comparatively harmless trees, with the result that although 'sissoo' is more innocuous in effect, its roots contained more alkaline constituents than those of bamboo. Evidently, therefore, the cause of the infertility did not lie in the alkalinity of the root constituents of the tree.

Further experiments were made in the direction of a suggestion that possibly the explanation of the phenomena might be in the movement of the solution of salts in the soil towards the tree. A growing tree transpires an enormous amount of water, thus exercising a great power of suction; so to speak, on the soil particles, because the roots have to abstract the water, which is transpired through the leaves, from the soil with which they are in contact. The soil therefore immediately near the roots is rendered drier than the rest of the surrounding earth, and therefore a movement of water from the wetter to the drier portions is automatically set up. This movement goes on as long as the tree grows, and along with the water the dissolved salts in the soil also move towards the tree in obedience to the influence of the roots.

To find out how far the infertility of soils under certain trees was due to the over-accumulation of soluble salts, samples of such soils from various places

were examined, and the content of soluble salts together with the amount of moisture in the soils determined.

From this examination it was clearly shown that infertility was not caused by a deficiency in moisture, for in some cases, owing to the nature of the soil, the 'bad' soil contained more moisture than the 'good' soil. The amount of water retained by a soil, and the rate of movement of that water are chiefly dependent on the nature of the soil.

The result of the analyses of the soils seems to show that the greater amount of soluble salts is found in the upper layers of soil nearest the trees exercising the deleterious influence, and that there is a distinct movement of soluble salts in the soil towards such trees. Samples of soil taken in a straight line from just beneath a tamarind tree to 50 feet away showed a regular decrease in the content of soluble salts as the distance from the tree increased.

In estimating the causes of such harmful accumulation of soluble salts many points have to be considered. In the first place it must be remembered that only the dissolved salts can practically exert any influence on the roots in the soil, and that therefore the moisture content of the soil is to be taken into account, as, given the same amount of salts, the less moisture, the more concentration, and vice versa.

The texture of the soil has also weight in this connexion. Loamy soils can contain innocuously a larger amount of salts than sandy soils can. And from the point of view of getting rid of soil toxicity, the texture of the soil is of great importance, because an open soil can much more easily be rid of saline accumulations by drainage and irrigation. Again, the nature of the accumulated salts is of importance. Some salts are more deleterious than others, and some crops can tolerate and thrive upon amounts of alkaline materials which would mean death and destruction to others.

As will have been gathered, the problem of the cause of infertile soil by the growth of certain trees is complicated, and by no means fully explained. It would seem, however, that this infertility is caused by the presence of soluble salts in injurious amounts. It would also appear likely that, though this accumulation of soluble salts may be due in some measure to the leaching out of the mineral matter in the decayed leaves and roots of the tree, yet that the transpiration of the tree, causing a flow of moisture and its contained dissolved salts towards the tree roots, is the most important factor. If this be so, plants having thin leaves like the tamarind, and therefore possessing a high

ratio of transpiration, would be likely to produce more harmful results than those having thick leaves with a lower ratio of transpiration.

It is also evident that the effect on the soil described will be more noticeable in dry districts, than in those where heavy periodic rainfall can wash down the concentrated salts from the higher levels, to which the upward flow of moisture has raised them, back to lower levels by natural irrigation. Thus the action of a tamarind tree or a clump of bamboo on the surrounding soil in a dry island like Antigua, would probably be more persistently harmful than in the wet island of Dominica.

In fact there is a tendency in all soils for the upper layers to become over saturated with alkali salts because of the moisture flow, which tendency, in practically rainless regions, gives rise to desert areas of more or less extent. By irrigation, combined with good rainage, these areas have been converted in many instances into fertile farms, because the undesirable excess of salts has been washed out of the soil.

The practical remedies for infertile patches caused by the influence of soil-toxic trees may be put into a small compass. The first step is to remove the tree; then the soil must be improved by deep cultivation and the addition of organic manures; and lastly, the drainage must be efficient, so that the deleterious excess of salts may readily pass out of the soil. To this end it is hardly necessary to add that, irrigation where possible, is a most valuable aid.

A MODERN CUBAN SUGAR FACTORY.

Cuba is now exporting millions of tons of sugar, and it seems likely that the export will continue to increase, if sufficiency of labour is obtainable. An article in the *Louisiana Planter*, September 22, 1917, gives a short interesting account of the wonderful efficiency of a large modern Cuban central factory. It is true that the natural advantages of Cuba for the cultivation of sugar-cane are great. It possesses fertile soil, tropical climate, and adequate rainfall. Still the position of Cuba in the sugar world is probably chiefly due to practical scientific work of sugar engineers, chemists, and machinery manufacturers.

The chief factor of increased output of sugar has been the use of larger and stronger mills, exerting pressure many times over on the canes. Some of the leading factories of the present day employ a series of four or more three-roller mills together with one or two cane crushers.

It has also been found that a certain amount of maceration in the process of crushing contributes to success in extracting the maximum of the sugar content of the canes. In view however of the fuel value of the megass, maceration is not carried out to such a thorough extent as would destroy its value completely in this direction.

The article referred to above gives an account of the work for the last crop season of the Delicias central factory in Cuba, which shows that 743,762 tons of cane were ground and 544,924 bags of sugar made, equivalent to some 90,000 short tons of sugar. The calculated normal extraction of juice was 82.65 per cent. of the weight of the cane, and the sucrose extraction 95.18 per cent. of sucrose in cane. Maceration, as referred to above, was done to the extent of 29.19 per cent., presumably in proportion to the whole weight of the diluted juice. The average rate of grinding for the crop was 86.22 tons of cane per hour. The final result of the whole crop was 11.98 per cent. of sugar to the weight of cane.

This array of figures demonstrates the success of scientific control in every direction in the modern manufacture of sugar on a large scale. That the scale is very large will be recognized by readers in the small sugar-growing islands of the West Indies, when it is realized that the output of sugar of this one Cuban factory is just about equal to the united output of Barbados, Antigua, and St. Kitts.

MOTOR TRACTORS FOR SUGAR-CANE CULTIVATION.

On another page of this issue will be found the opinion of the Consulting Engineer of the Royal Agricultural Society of England on the probable future of motor tractors in agriculture. In the *Louisiana Planter*, September 29, 1917, appears a letter to the editor from a correspondent in British Guiana, pointing out the difficulties of using motor tractors in cultivation of cane fields in that colony, and suggesting possible modifications in structure of the machines, which would render them suitable for employment under the local conditions.

In commenting on this letter, the editor points out the immense expense which would be incurred by any tractor engine manufacturer in making any serious modification of the machine. An enormous market would have to be open to such a modified machine, before a manufacturer would entertain any such idea. He still believes that the motor tractor is bound to play an important part in the cane cultivation of the future. He suggests that some of the difficulties pointed out by his British Guiana correspondent may be overcome by a change in the plan of laying out fields.

The problem of the use of motor tractors for cultivation of small fields, especially on those of irregular surface, such as is the case on probably most estates of the smaller islands, seems not to have been faced as yet in these islands. Motor tractors up to the present are being used for other purposes, such as haulage of cane, and this with good results. But probably some sugar planter will have to take the bull by the horns, or rather the motor by the wheel, and experiment at his own risk of losing money for the benefit of himself and other planters.

From the Blue Book Report of the Turks and Caicos Islands for the year 1915, it would appear that the salt industry of these islands is in a fairly flourishing condition, whereas the export of sponges in consequence of the war is much diminished. An interesting item of export is conchs which are exported for food to the neighbouring republic of Haiti. Upward of 1,750,000 conchs were exported during the year, the value of which was £1,715.

THE QUALITY OF PLANTATION RUBBER.

The cause of variability or lack of uniformity in the quality of Para rubber (*Hevea brasiliensis*) has been the subject of very much discussion and investigation from time to time in years past, and considerable work has been done during recent years (see *Agricultural News*, Vol. XIV, No. 338, p. 125; No. 348, p. 283; No. 349, p. 295) by experiment station workers in the larger rubber-growing countries, acting on their own initiative, or conducted by the Departments of Agriculture of those countries themselves. Lately, as readers are probably aware, this work has been of the nature of experiments in vulcanization, the speed of vulcanization (rate of cure) being the quality in Plantation rubber which is most liable to variation; and in a paper which appeared in the *Agricultural Bulletin of the Federated Malay States*, for July 1916, describing what were then the latest results in the investigation of the question of lack of uniformity, new and important results, a summary of which was published in the *Agricultural News*, Vol. XV, No. 382, p. 415, seemed to have been obtained regarding the cause of differences in vulcanizability, and showing where these differences lie—difference in quality which is very trying to the manufacturer, and has bred a certain amount of distrust in Plantation rubber.

The results of further experimentation on a more extensive and elaborate scale, which has been in progress during the last three years, have since come to hand, in which most valuable and important conclusions appear to have been reached. These are published in the *Bulletin of the Imperial Institute*, Vol. XIV, No. 4, October-December 1916, and are presented in the form of summaries prepared from a selection of Reports made by the Directors of the Imperial Institute, to the Colonial, Indian, and other Governments concerned, of investigations of the quality of Plantation rubber conducted under the Ceylon rubber research scheme. This is a scheme of rubber research arranged by the Government of Ceylon in conjunction with some of the principal planting companies in the island and with the Imperial Institute, and has been in progress during the last three years. The object of the scheme is to provide for a continuous and systematic investigation of the special problems which arise in the production of Plantation rubber, with particular reference to the suitabilities of the rubber for manufacturing purposes. A fair conception of the extensive nature of the experiments undertaken, and of the very considerable amount of work involved, may be gained when it is mentioned that these summaries occupy no fewer than seventy pages of the total number of 185 of which the *Bulletin* is comprised.

The investigations recorded deal with the effect upon the mechanical properties of the vulcanized rubber of (1) different methods of coagulation; (2) the addition of various substances to the latex in order to retard coagulation; (3) the form of the rubber; (4) the method of drying; (5) 'over-working' freshly coagulated rubber in the washing machine; (6) various methods of smoking; (7) drying sheet rubber under tension; (8) rolling up wet and dry sheet rubber with and without tension; (9) the conversion of wet and dry crêpe rubber into block, and (10) separating the rubber from the latex in successive portions.

Tabulated results of chemical analyses, and of vulcanization and mechanical tests are given, and in the general discussion of the results it is stated that these show that it is in respect of the time required for correct vulcanization that Plantation Para rubbers, prepared by different methods, exhibit the greatest variation—thus confirming results previously obtained.

The more important conclusions which have been reached during the course of the present inquiry are summarized at the end of the article under reference. Reproduced below will be found such of these as are applicable to conditions in the West Indies and should prove instructive and of value to rubber growers and others interested in the development in the rubber industry in these colonies.

GENERAL CONCLUSIONS.

Spontaneous coagulation of the latex usually yields rubber of good quality which cures quickly, but the method is scarcely suitable for practical use.

Scrap from the trees has invariably given a low tensile strength after vulcanization.

Acetic acid is quite satisfactory as a coagulant, and, so far as the vulcanizing and mechanical properties of the rubber are concerned, there would appear to be no advantage in using any other acid in place of it. Further, excess of acetic acid is less likely to affect the rubber adversely than excess of some acids, such as sulphuric acid.

Plain unsmoked sheet rubber is usually of excellent quality, the vulcanized product having as a rule a tensile strength of 2,300 to 2,400 lb. per square inch. The rubber also vulcanizes fairly rapidly, the average time under the conditions of the present series of tests being about seventy minutes.

Crêpe rubber invariably takes a much longer time to vulcanize (105 to 130 minutes) than the corresponding plain sheet from the same latex, and this effect is brought about even if the freshly coagulated rubber is only passed through the rough rollers four times. The mechanical properties of crêpe rubber after vulcanization are very frequently inferior to those of the corresponding plain sheet.

The 'over-working' of the freshly coagulated rubber in the preparation of crêpe (up to seventy times through the rough rollers) has very little effect on the mechanical properties of the vulcanized rubber, and only slightly increases the time of vulcanization compared with that of crêpe made by passing through the rough rollers only five or seven times.

Thick crêpe rubber, made by rolling together several pieces of thin crêpe, does not differ from the latter in time of vulcanization, and the differences in tensile strength are not very marked or constant. Thick crêpe, made by rolling out the coagulum to the required thickness, usually vulcanizes in a shorter time than the corresponding thin crêpe.

Different methods of drying (air-drying at the ordinary temperature, drying in hot air, and in *vacuo*) have very little effect on the time of vulcanization or the tensile strength of the rubber.

The smoking of sheet rubber increases the time of vulcanization very considerably, and in some cases appears to affect adversely the mechanical properties of the vulcanized product.

The addition of an alkaline solution of creosote to the latex before coagulation does not affect in any way the properties of the dry sheet rubber.

Pressing the dry rubber into block or rolling it up with or without tension has very little effect on the time of vulcanization or on the mechanical properties.

There is no marked difference in the time of vulcanization or physical properties between the rubbers obtained by coagulating latex in two or three fractions.

Rubber which is allowed to remain in a wet condition after coagulation (creosote having been added as a preservative) appears to have invariably a short time of vulcanization, and to give very good mechanical results after vulcanization. Such rubber loses some proteins on washing.



GRENADA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1916-17.

This report from Grenada, which has just been issued, presents many noticeable features, and shows that the work of the officers of the Department is tending to advance the agricultural interests of the colony in several directions. Especially is this apparent in the attention that is evidently being taken with regard to the cultivation of other crops besides cacao and spices.

With regard to these two, which have been for years the chief export crops of Grenada, the report under review gives a very satisfactory account. The cacao crop of 1916 has been the largest recorded, the number of bags of 180 lb. exported being 76,980, exceeding the previous record of 1910 by 3,117 bags. The spice crop—nutmegs and mace—has also exceeded that of any previous year. In this crop there has been a steady increase for the last six years from 909,280 lb. in 1910 to 1,940,965 lb. in 1916.

The variety of cotton known as Marie Galante is grown largely in Carriacou, and although the amount produced in 1916 was somewhat less than in 1915, the value of the whole crop was very much larger, owing to the better prices obtained. The report considers that this crop needs more attention in the matter of tillage.

Much more interest is being taken in the cultivation of limes in several parts of the colony. For some years past a considerable acreage has been devoted to this cultivation in Carriacou, but for the last two years there has been a large increase in the area put under limes in Grenada also, as is evidenced by the fact that, during that period, no less than 54,451 young growing lime trees have been distributed from the Botanic Garden nurseries. The increasing importance of this industry is also shown by the increase in value of the exports of lime products. In 1914 these were valued at £1,375, in 1915 at £6,407, while in 1916 they were estimated at £14,486, entirely in raw concentrated juice. The lime industry in Grenada and the Grenadines is certainly advancing by leaps and bounds.

It is satisfactory to note that much more attention is being paid to the cultivation of food crops. This seems to be largely due to general interest shown lately by the community in the matter, and to the efforts of the officers of the Department in stirring up attention to the subject among peasant proprietors, although the report still thinks that much more might be done in growing crops for local food supply. The visits paid by the Superintendent of Agriculture and the two Agricultural Instructors to all parts of the colony, and the instructions as to all sorts of crops which naturally result from such visits must in time bring about a satisfactory condition of affairs in the cultivation of food crops.

In this connexion the Prize Holdings Competitions, which are held under the auspices of the Grenada Agricultural and Commercial Society, will doubtless stir up in the future wholesome emulation in the cultivation of provision

grounds, as they evidently have done in the past with regard to the cultivation of cacao. In 1916 the competitions were carried out with the co-operation of the Agricultural Department, the Agricultural Instructors being entrusted with the responsible work of judging the plots. The total number of entries was 362, and a large amount of work was thus devolved upon the instructors who visited each holding once or twice previous to making their awards. The competitions were in two sections: the cacao section, in which fifty-seven prizes were awarded, varying in value from £5 to 10s.; and the provision garden section, a new feature, in which twelve prizes were awarded of the total value of £36. The report remarks truly that not only do these Prize Holdings Competitions rouse a healthy emulation among the peasant proprietors, but that they secure to the Agricultural Instructors a welcome to the holdings, and afford them an opportunity of giving profitable instruction to the competitors.

The portion of the report dealing with Land Settlements gives a very satisfactory account of the success which is attending the working of the scheme. It may be remembered that the plan which was first tried in Carriacou has succeeded there most admirably. It is evidently being taken up in Grenada also, and will doubtless conduce to the prosperity of the peasant farmers there, just as it has done in Carriacou.

A feature of this land settlement plan is that in every one of the settlements—three in Grenada, and one in Carriacou—a plot of land is reserved by the Agricultural Department as an experiment station. These serve as most useful centres, not only of experimental work with various crops, especially new ones, but also of instruction in good cultural methods to the settlers.

Reference has been already made to the extension of the lime industry. The cultivation of coco-nuts as a new agricultural development is also being taken up, as is evidenced by the fact that 2,356 coco-nuts for planting have been distributed from the nurseries during the year reported on.

The advantage of growing the horse bean (*Canavalia ensiformis*) as a green dressing for cacao plantations seems to be well recognized in Grenada, shown by the fact that 3,391 lb. of these beans were distributed for the purpose from the stations. An account of experiments with this bean in this direction appeared in a recent number of this Journal. It is worth noting that this bean is also edible and worth cultivating for this reason as well.

The very interesting and successful experiment made by the Superintendent of Agriculture in storing seed-corn was also related in the *Agricultural News*, No. 401, September 8, 1917. It is quite plain that there ought to be no necessity to import corn for that purpose.

With regard to plant diseases, the cacao thrips gives some anxiety to planters. The officers of the Agricultural Department disseminate widely the advice given by the Entomologists of the Head Department, which advice, if followed by planters, would probably soon lead to the diminution of the danger from the disease. Experiments are being conducted with a fungus parasitic to the thrips. If successful, this method of control may also prove valuable.

The question of forest preservation, it is satisfactory to note, continues to receive attention by the Government. It is certainly in the interests of the island to conserve the forests remaining on the higher peaks at least.

The whole report goes to show that the agricultural prosperity of the colony continues, and that the Agricultural Department's efforts are not without effect in stimulating progress towards improvements in cultural methods, as in other directions.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents, and the subscription and advertisement rates, will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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NOTES AND COMMENTS.

The editorial deals with reasons for infertility of soil around certain trees.

Insect Notes on page 346 deal with the pink boll worm of cotton, and on page 347 there is a note on trapping the black weevil borer of bananas.

An article on salads and spinach on page 349 affords matter of local interest to West Indians.

Under Plant Diseases, page 350, the Mycologist's report on a fungus disease of lime trees in Dominica is concluded.

Correction.

In a recent issue of this Journal, p. 310, the statement is made that last season 10 tons of cane were taken at Moreland factory in Jamaica to make 1 ton of sugar; this is erroneous: the correct figure for this period is 9.375 tons. The figure formerly given relates to Amity Hall factory, which is adjacent.

The Production of Rubber in Germany from Indigenous Weeds.

Reports have been frequently heard that synthetic rubber is being manufactured in Germany, but nothing tangible has as yet been really produced. The German scientist, Scheermesser, has devoted much attention to some indigenous plants, especially to members of the Euphorbiaceae, from the milk of which a certain percentage of rubber substance may be obtained. The results are considered sufficiently satisfactory to encourage further research, especially with regard to *Tithymalus Peplus*, a common garden weed in Germany. It is estimated that, if cultivated, the crop on one hectare (about 2½ acres) will produce 43 kilos. of rubber and 120 kilos. of fatty substance. Another weed, also common, which promises even better results, is *Euphorbia Cyparissias*, which is estimated to produce on the same area 50 kilos. of rubber and 140 kilos. of fat. The fat obtained, however, would be poisonous, as both these plants are poisonous, and therefore it would not be fit for human consumption, but, perhaps it might be utilized in soap making, or for the production of glycerine. The German expectations in this direction, says the *India Rubber Journal*, for July 28, 1917, based on even so slender a foundation, are so sanguine, that they hope to be able to render themselves independent of the tropical rubber trees.

Bats as Guardians of Cotton.

A correspondent from Bahia, Brazil, Mr. George M. Chard, commenting on the pamphlet 'Cotton Cultivation in the West Indies', No. 74, issued by this Department, says: 'Most of the pests and diseases you describe are common here. As regards boll worms, cut worms and other products of night-flying moths, I have found prevention better than cure, and that the surest means of dealing with these pests is the establishment of colonies of insectivorous bats. A dark shanty, with a few cross poles near the roof, makes them an attractive domicile, and it is not long before a colony is attracted thereto.'

In the *Agricultural News*, Vol. XIII, No. 311, p. 106, there was an article giving an account of how colonies of bats had been established at San Antonio, Texas, for the purpose of combating mosquitoes and at the same time for producing guano. In cotton districts in these islands it might be worth while trying a similar experiment. It must be remembered, however, that the larger fruit-eating bats, which are perhaps even more common with us than the smaller insectivorous kinds, would be of no use in this direction. So experimenters must carefully select their colonists, and not encourage undesirable aliens.

Plants Poisonous to Live Stock.

Nature for August 23, 1917, reviews a book by H. C. Long with the above title. This book deals with plants poisonous to live stock in the United Kingdom, but some of the author's conclusions apply to any part of the world.

Poisonous plants differ widely in degree of harmfulness. Probably, under ordinary conditions, many of the plants regarded as poisonous are almost harmless. Animals in their natural state appear to avoid these poisonous plants, and to be less readily poisoned than are domesticated animals. Again, some animals seem to have a depraved appetite for unusual food-plants. The author quotes a remark of an American writer that 'there seems to be no way of accounting for the appetite or taste of stock.' This statement is perhaps especially true of sheep, which will eat greedily on one day plants that they could scarcely be persuaded to eat on the following day on the same pasturage. The poisonous properties of a plant are often affected by conditions of soil, climate, and cultivation. So much so that a plant is sometimes regarded as harmless in one country, and poisonous in another. Again, a plant may be poisonous in all its parts, or one part alone may be toxic. Frequently also there are variations in the poisonous character according to the season, or some parts of the plant may be much more toxic than others.

Cotton and Wool Spun from Glass.

An interesting account, taken from a report of the United States Consul in Venice, is given of the making of these articles in the *India Rubber Journal*, August 25, 1917. The article referred to says that 'the spinning of glass for commercial uses has developed into an important industry in Venice. . . . The spun glass is marketed in three forms—hanks of spun glass thread of straight fibre called glass cotton, masses of spun glass curled fibre called glass wool, and either of the above qualities pressed into sheets or pads from $\frac{1}{4}$ -inch to $\frac{1}{2}$ -inch in thickness that resemble white felt pads. At present the principal use made of this product is for insulation, and especially for making separators for accumulators of electricity, but the glass wool would serve admirably for making artificial hair, and other purposes, and in the pad form it serves as a hygienic filter.

'The processes of manufacture are simple. Solid glass rods about 2 feet 6 inches long and the thickness of a lead pencil are made of pure American soda that contains no adulteration of lead or other metal. The absence of lead and adulterations gives the quality of perfect flexibility to the fibre. . . . On a desk is mounted a Bunsen burner or gas flame and blowpipe. By the side of the desk is mounted an ordinary bicycle wheel minus the rubber tyre, that revolves rapidly and regularly at rhythmic speed under power furnished by a small electric motor. The hank of thread on the wheel, when it has assumed the dimensions of a bicycle tyre, is taken off. Separated with the fingers it curls and fluffs out like wool, if the thread is

sufficiently fine. It is packed in the hank as glass cotton, in the fluff as glass wool, and in the compressed form as glass wool or cotton according to the fineness of the fibre.'

Influence of Limestone on Crop Yield.

It is generally assumed that burnt or slaked lime is the most efficient form in which to employ lime for agricultural purposes in applications to the soil. Recent investigations have been made as to whether finely ground limestone may not be equal, if not superior in value for the purpose to the caustic forms of lime. An account of investigations and experiments in this direction is given by Nicholas Kopiloff, Research Fellow, Rutgers College, New Jersey, in *Soil Science*, July 1917. In the experiments limestone was ground to various degrees of fineness, from passing through a sieve having twenty meshes to the inch to passing through one having 200 meshes to the inch.

It would seem that the following points amongst others, have been established by the experiments: (1) An increase in fineness of division of pulverized limestone is responsible for a proportional yield of crop on several soil types. (2) There was little choice in effect between burnt lime and 200-mesh limestone. (3) An increase in fineness of division in pulverized limestone increases the activity of the bacteriological processes of ammonification, nitrification, and nitrogen fixation.

In general the conclusion is reached that an increase in the fineness of division of pulverized limestone is responsible for a proportionate increase in crop yield, as well as for exerting a beneficial effect on the chemical factors in the soil. In these respects 200-mesh limestone may be regarded as effective as burnt lime.

How to Keep Coco-nut Butter Firm.

The *Journal of the Jamaica Agricultural Society*, August 1917, gives directions for the construction of an iceless refrigerator which can keep coco-nut butter from 6° to 10° below the ordinary shade temperature. This device can be used to keep any article that depends on a low temperature for its well-being.

A series of shelves is made to fit into upright legs, leaving the sides open. The most convenient size for these shelves is probably about 18 inches square. The legs are placed in a tub—any ordinary zinc tub will do; and on the top of the shelves a fairly large pudding pan is put. The sides are covered with a piece of flannel or flannelette, cut, and sewed to fit the whole construction. The lower end of the cloth hangs down into the tub, and the upper ends, which must be about 9 inches taller than the structure, fall over into the pudding pan. Water is now put into the two vessels and capillary attraction causes an upward and downward movement of water, which evaporates very quickly, thus lowering the temperature. It will be found that the upper vessel will have to be refilled two or three times a day. Not only for keeping coco-nut butter firm, but for keeping meat, and milk, and ordinary butter this refrigerator will be found of service in any place where it is difficult to obtain ice,

INSECT NOTES.

THE PINK BOLL WORM.

(*Pectinophora* [Gelechia] *gossypiella*, Saunders.)

This insect has more than once been the subject of articles and brief notes in the pages of the *Agricultural News*, the more recent references being those of April 21 and May 19, 1917, where mention was made of the discovery of this pest in Mexico and Brazil, respectively. Since the appearance of the later of these two notices a bulletin of considerable importance has been published by the United States Department of Agriculture giving the latest information on the life-history and habits of this pest. It has seemed advisable, therefore, in the first place to bring the more important points contained in this article to the attention of readers of the *Agricultural News*, and secondly, to refer briefly to the measures which have recently been taken in the British West Indies to guard against the introduction of the pink boll worm into these islands.

Since 1915 this insect has formed the subject of a detailed study in the Hawaiian Islands where the cultivation of cotton has practically been abandoned owing to its ravages. These investigations have been carried on in Hawaii mainly by Mr. August Busck, of the United States Bureau of Entomology, and the results have recently been published in the *Journal of Agricultural Research*, Vol. IX, No. 10.

The pink boll worm was first described from India, but later evidence points to Africa as being the original home of this insect. It has spread to most, if not all, of the cotton-growing districts of Africa, Asia, Japan, Ceylon, Straits Settlements, Philippines, and Hawaiian Islands, and has within the last few years become established in Brazil and Mexico. It is now considered to rank among the half-dozen most important insect pests of the world. Some examples showing the extent of its damage within recent years may be of interest. It was stated in 1916 that in Egypt the pink boll worm often reduces the yield of lint 50 per cent. or more, and materially lessens the amount of oil obtained from the seeds. A recent report by Gough of the damage caused by this pest states that it now occurs wherever cotton is grown in Egypt; in the last week of October 1916, 87 per cent. of the green bolls in Lower, 78 per cent. in Middle, and 60 per cent. in Upper Egypt were attacked by it. Maxwell-Lefroy estimated in 1911 that the minimum loss in India from the insect is more than £2,000,000 annually.

In the Hawaiian Islands during 1915 the boll worm infested from 50 to 99 per cent. of the bolls in the few fields of cotton still being grown, and destroyed from one-half to nine-tenths of the lint. The introduction of the pink boll worm into Brazil was referred to in a brief note in the *Agricultural News* of May 19, 1917, in which it was stated that up to 1914 this insect was not found to be present in Brazil, but that towards the end of 1916 another survey of the cotton districts showed that the pest had become thoroughly established. Recent reports show that last year the pink boll worm caused a loss of 50 per cent. of the cotton crop in some localities. It is now recognized that this insect will continue to take its toll of the cotton industry in Brazil, as it is doing in other infested countries, in spite of any measures which may be taken to control it.

LIFE-HISTORY.

The small eggs are laid singly or in small groups on any part of the green cotton boll or its calyx, or even in the

flower, but are by far most commonly found near the apex of the green boll in the slight longitudinal depressions which indicate its divisions. Dissections showed that a single moth is capable of laying more than 100 eggs. These hatch in from four to twelve days after they are laid.

The young larva is nearly pure white, and it is only in the fourth and last instar that it assumes the pink colour that has given it the popular name of pink boll worm. A detailed account of the feeding habits of the larva is given by Mr. Busck, and some of the main points are of interest. The newly hatched larva bores into the boll under or near the egg-shell, and its subsequent progress seems to depend partly upon the position of the egg and the condition of the boll, and partly upon the direction the larva may happen to choose. It usually bores in near the apex of the boll, and tunnels down through the soft inner walls to the base of the boll before it attacks one of the lowest seeds. Then it gradually works its way upward again, feeding on the seeds as it goes, and finally ends as a mature larva in one of the seeds nearest the tip of the boll. The larva feeds exclusively within the cotton boll, and does not attack the leaves or shoots. It usually confines its attacks to a single section of the boll, but may wander into adjoining sections. When, as is often the case, two, three, or more larvae infest a single boll, the value of the seeds and lint is entirely destroyed.

The larval stage occupies from twenty to thirty days during the summer in Hawaii, but this period may be much prolonged in colder weather, or under abnormally dry conditions. In temperate climates the insect passes the winter as a larva within the seeds.

The pupa is usually formed within the boll, partly inside the last seed attacked by the larva. Before completing the cocoon, which consists of a single, thin, but rather tough, layer of dirty-brown silk, the larva eats a round hole through the outer wall of the boll to insure the escape of the issuing moth. The pupal period lasts from ten to twenty days.

The moth is small, dark-brown, inconspicuous, and sluggish. It is rarely seen in nature, since it hides during the day on or near the ground, and sometimes even burrows into the surface of the soil. Egg-laying usually begins soon after emergence, and the moths die shortly after oviposition. The entire life-cycle may under favourable conditions be completed in thirty-five days, but about fifty days seems to be the more usual period.

HABITS OF THE MOTH.

The secretive habits of the moth were well shown by a number of experiments made both in the field and under artificial conditions indoors. In the outdoor experiments several dozen moths of this species were repeatedly liberated in the middle of a cotton field, by shaking them out of a jar on to the ground. Within a minute none were in sight; all had effectively hidden away on the uneven surface of the ground. Under indoor conditions hundreds of moths were liberated weekly, but rarely were any to be found during the day-time.

This moth shows an aversion to light of any kind, whether it be sunlight, diffused daylight, or artificial light. During the day it hides in obscure places, and only becomes active at dusk. Experiments have been made to try and attract this moth to traplights, but without success. Strong kerosene and acetylene lamps, placed in a most effective manner with white sheets as backgrounds, on a porch and in the windows of a cottage surrounded within 20 feet by heavily infested cotton fields, failed to attract a single individual of *Pectinophora gossypiella* during many evenings.

and nights, though efforts were made to disturb and dislodge them in the fields by beating and shaking the cotton bushes. Trapplights have been recommended by various investigators for use against this pest, but the above experiments have shown such methods to be valueless.

Mr. Busck says the idea that these moths were attracted to light is based on unsatisfactory evidence, and is probably due to misidentification of the material collected in the traps.

These notes will be continued in the next issue.

J.C.H.

THE BLACK WEEVIL BORER OF BANANAS.

In the memorandum on the black weevil borer of bananas (*Cosmopolites sordidus*) addressed by the Commissioner of Agriculture to the Governor of Jamaica in April last, the suggestion is made that sliced banana bulbs placed on the ground in banana fields may prove so attractive to the weevils that they may congregate in such numbers on the material as to make it easy to collect them as a means of control. This fact has been verified by the Director of Agriculture of Jamaica, who states in a recent communication that sliced banana bulbs are proving very attractive to the above insect pest of bananas in that island, and that this material is being used to trap the weevils, which are then collected and destroyed. These traps are now in use in several localities infested by this pest, and in one place as much as 2 quarts of weevils were collected by this means over an area of $\frac{1}{2}$ -acre, and these measures resulted in a subsequent scarcity of weevils in that locality.

The above method of trapping the black banana weevil is certainly worth a trial in those islands where this insect is known to be a pest, as it may prove to be useful not only as a means of reducing the numbers of this weevil but also of determining whether it is present in a given locality or not.

The employment of good cultural methods especially in weevil-infested areas, is apparently meeting with marked success in Jamaica, and has already resulted in the production of vigorous and healthy banana plants in what were formerly considered bad weevil districts.

In addition to being useful as a means of trapping this pest, the employment of sliced banana bulbs may be recommended as a means of ascertaining the presence of this pest in banana cultivation.

It is hoped that experiments be made by agricultural officers in this direction as widely as possible, in order that the distribution of this insect in each island, and amongst the islands may be ascertained.

THE SWEET POTATO ROOT WEEVIL.

In the course of a review of some insect pests of Jamaica in the *Agricultural News* for September 22, 1917, the distribution of the above insect (*Cylas formicarius*) was given, and reference was made to the fact that this pest has recently become established in some districts of the State of Florida. A public notice has recently been issued by the State Plant Board of Florida declaring that the sweet potato root weevil is an insect pest, and that sweet potato plants, vines, slips, cuttings, draws, and tubers, and morning glory (*Ipomoea* sp.) vines and roots are likely to become infested by said insect pest. This notice also declares certain definite areas within the State of Florida to be already infested with this pest, and prohibits the movement or shipment of any of the above

parts of the sweet potato or morning glory plants from such infested areas into or through all parts of the State of Florida other than the specified infested areas. Further, the notice prohibits the movement or shipment of sweet potato tubers in the manner stated above unless first fumigated by an agent of the Plant Board and certified by him.

The above notice is not to be construed as preventing the shipment of sweet potato tubers from infested sections in the State of Florida to points in other States when such tubers are securely sacked and shipped in tightly closed cars in carload shipments; further, the shipment of canned sweet potatoes is not prevented by the notice.

AGRICULTURAL DEVELOPMENT IN INDIA.

The *Field*, of September 8, 1917, contains a short article on the above subject, from which we take the following extract:—

The emphasis which is naturally and very properly laid on the immensity of the resources, actual and potential, possessed by the Dominions of the Overseas Empire, with their wide tracts of arable and pastoral country calling out for development by white settlers, has a tendency to push into the background remembrances of the immensity of India's resources. Yet the part which that wonderful country plays in the economy of the Empire is already one of prime importance, and is destined to assume still larger dimensions. There are in India nearly three-fourths of the total population of the British Empire, and the production of food supplies and raw materials for the requirements of its three hundred millions and more inhabitants is on a scale of which few people have conception. Though the home requirements of India absorb the bulk of its production, the small fraction which alone remains for export, in the case of most of its crops, suffices to place it in the front rank of the countries from which the United Kingdom draws its supplies. With its hundreds of millions of people and hundreds of millions of acres under crop, India cannot be called an undeveloped country; yet the future of its agricultural industries contains the promise of very great expansion. The possibilities of such expansion consist not only in the increase of the area under cultivation, but in the increase of the average yield. Take the case of wheat for example. Rice may be the staple article of diet throughout the greater part of India, but wheat is the main food crop of the people of Upper India. From 80 to 90 per cent. of the crop is retained in the country for local requirements, but the remaining 10 to 20 per cent. furnished us before the war with between one-fifth and one-sixth of our imports of wheat. The expansion of cultivation has been very marked during recent years. The average area under wheat cultivation in India during the last five years of the last century was rather more than 22½ million acres; the preliminary estimate for this last season, 1916-17, was 33 million acres, an increase of nearly 50 per cent. The fact that the fluctuations in the area under a single crop in India may be measured in millions of acres from year to year is in itself a striking indication of the scale on which Indian agriculture is practised. The average yield, however, of this last year's wheat crop is estimated at only about 11 bushels per acre, so that it will be seen how much may be hoped from the efforts which are being made by the Imperial and Provincial Departments of Agriculture to introduce improved varieties of wheat, efforts which have already begun to be attended by gratifying success.



GLEANINGS.

In the grinding season just closed Porto Rico has produced the largest crop of sugar recorded in the history of the island, it having been 502,398 tons of sugar. (*The Louisiana Planter*, September 1, 1917.)

Guinea corn is a grand crop for dry districts, and it gives far more green forage per acre than Indian corn, because it grows up again. *The Journal of the Jamaica Agricultural Society*, July 1917, says: 'We have had Guinea corn grazed out by cattle six times, yet it grew up again and produced small heads.'

The *Demerara Argosy*, October 13, 1917, reports the prosecution of three farmers for having failed to comply with the orders of the Agricultural Board in respect to the locust pest in Essequibo. Two of them were given a fortnight to carry out the orders, the third having failed to appear, the Bench issued a warrant for his apprehension.

The *Canada West India Magazine*, September 1917, suggests the possibilities of raw materials for paper manufacture being obtained from the West Indies, ranging from some of the sedges (*Cyperus* spp.) to bamboo and wood pulp from large forest trees. Perhaps, too, the unutilized megass of sugar mills might afford a supply of pulp not much inferior to wood pulp for paper making.

The Report of the Agricultural Department of the Northern Provinces of Nigeria for 1915 shows that the department is influencing the cultivation of sugar-cane in the Maigna district. Varieties of pedigree cane from Barbados have been introduced and taken up by native cultivators, with whom they have proved extremely popular, being stouter in growth and containing a higher percentage of sucrose than the indigenous canes.

The *Journal of the Jamaica Agricultural Society*, August 1917, states that after the hurricane of 1916 there might easily have been a greater calamity in an absolute lack of foodstuffs, but for the prompt, systematic, and organized efforts of the Society. Supplies of seeds and plants were organized; from districts where there was a sufficiency of one thing supplies were sent to other districts where there was a scarcity.

Increasing attention is being given to cacao growing in Uganda. Of the acreage under this crop 159 acres contain trees over five years old, 4,113 acres bear trees under five years old, and 689 acres have just been planted. The crop has a number of serious insect pests and diseases, but provided that necessary precaution is taken, and suitable situation selected, this crop promises well. (Annual Report, Department of Agriculture, Uganda, 1915-16.)

The Tootal Broadhurst Lee Company has decided to set aside £10,000 a year for five years for the promotion of research and education. According to *The Times*, the provisional committee on research and education for the cotton industry will, at the close of the current holiday season, issue a prospectus of the new organization. This definite industrial research federation of the cotton trade will be followed by the establishment of institutes and laboratories. (*Nature*, August 23, 1917.)

According to the *Chamber of Commerce Journal*, August 1917, the French Government is encouraging the cultivation of fibre-producing plants in French West Africa. The *Journal officiel de l'Afrique occidentale Française* states that at the request of the Government General an official study of the uses of 'da' fibre (*Hibiscus cannabinus*) grown in French West Africa has been made. Though, at present, this fibre cannot replace jute in the manufacture of tissues, it is well adapted for rope making.

The production of sugar in Peru has largely increased of late years. The area suitable for the growing of sugar-cane on the west coast of Peru is limited only by the available supply of water for irrigation. In some districts the supply of subterranean water has been tapped, and the use of centrifugal pumps for bringing it to the surface has made it possible to increase the area under cultivation. The production of sugar has grown from 178,533 metric tons in 1911 to 262,840 tons in 1915. (*The Journal of the Royal Society of Arts*, June 22, 1917.)

The resolution establishing a Standing Cacao Subcommittee, adopted at a meeting of members of the West India Committee interested in the cacao industry on August 28, was confirmed by the Executive on September 6. At a further meeting of the Cacao Section—as it will now be called—on September 18, a Working Committee was appointed, comprising the Chairman, the Deputy-Chairman, Mr. W. Gillespie, Mr. G. M. Frame, Mr. E. A. Robinson, and Mr. J. E. Munro, with powers to add to their number. (*The West India Committee Circular*, September 20, 1917.)

According to the American Consul at Yokohama, a few small shipments of mustard seed were made in 1914 to introduce the Japanese product into the United States. This resulted in several large orders for 1915, as the superiority of the Japanese mustard seed over the Chinese was at once recognized. The soil and climate of Japan are well adapted to the growth of mustard, and a considerable increase in the cultivation has taken place. The production in 1915 was 15,500 bushels, valued at \$30,000; in 1916 it was 30,000 bushels, valued at \$60,000. (*The Chamber of Commerce Journal*, August 1917.)

According to the *Bulletin of the Imperial Institute*, pine-apple fibre is produced in fairly large quantities on the island of Hainan and in some districts of the mainland opposite. It is also produced on a smaller scale in the Philippine Islands, where the fibre is made into the fine fabric known as pina cloth. For fibre production the plants are grown closer together than when fruit only is required, or they may be grown under trees in partial shade, in order to induce the formation of long leaves. The best fibre is produced by very tedious manual labour, as the machine product is not of such good quality. In the Philippines 50 to 60 lb. only of fibre is obtained per ton of green leaves.

SALADS AND SPINACH.

As regards ordinary daily food, many people think that all essentials are met if a certain amount of meat, fish, and vegetables such as potatoes, rice, corn, and such like, together with bread, is provided for the daily consumption of the household. This is really a grave mistake. There are contained in fresh fruit and greens, substances—salts of various kinds and the more recondite vitamins—which are essential to bodily and mental health. Such articles of diet as salads and spinach do not contain the protein or nitrogenous contents which constitute the principal necessities of nutritious food, yet without such articles the human body could not be preserved in a really healthy condition.

In the West Indies, as in all tropical countries, Europeans and their descendants are prone to eat too much meat or too much of starchy vegetables, without combining them with the fruit or greens which are necessary everywhere, and perhaps most necessary under the climatic conditions of the tropics. Yet the materials for such requisite additions to diet are at hand in abundance in the West Indies at least. The object of this article is to show to West Indians that they need never be without a salad or a dish of spinach.

To begin with salads; we all know that we can grow delicious lettuce from imported seed. Care in the preparation of beds, and in keeping the seed sown from attacks of ants, together with adequate watering in dry weather, will result in crisp, tasty lettuce all the year round in these islands. It is worth while remembering that lettuce will produce with us good seed for several generations, only the flowering stalks must be protected by gauze bags from sparrows, who seem to take a special delight in lettuce seed.

But there are indigenous plants capable of being made into delicious salads by the addition of ordinary French dressing of vinegar, oil, salt, and a suggestion of sugar. Throughout the smaller islands a plant (*Portulacca oleracea*) known in many of them as 'pussly'—evidently a corruption of the English purslane—is a very common weed in cultivated land. The leaves plucked from the stem and given a French dressing make an excellent salad. The European cress (*Lepidium sativum*) is a delicious salad when eaten young by itself, or in a mixture with other leaves, and we have in the West Indies a member of the same genus (*Lepidium virginicum*) which, when treated in the same way, is just as tasty. This common weed is known in many of the islands as 'Pepper Grass'. The cosmopolitan weed (*Sonchus oleraceus*), called in some of the West Indies 'Sow Thistle' though too bitter if allowed to grow large, in its young state with only six or eight leaves developed, makes an excellent salad, and if blanched, by inverting a flower pot or something similar over the growing plant for a few days, it is really good. One more salad plant must be catalogued here. All along the sea coasts of these islands there is found growing profusely the 'sea purslane'. Its thick succulent leaves have a crisp break, and a salt flavour. Leave out the salt in the French dressing, and *Sesuvium portulacastrum* makes a delicious salad. The early colonists in Jamaica made use of this plant according to Sloane, who writes of it in his history of Jamaica, published in 1707, 'Tis pickled, and eat as English Sampier.'

To come now to spinach; the writer of this article has never seen the European or American spinach grown successfully in the West Indies, but he knows of excellent substitutes. Perhaps the best is the East Indian *Basella alba*, which is a trailing plant along the ground, or which can be trained very well over a fence. The leaves and young shoots of this are delicious when cooked like European spinach. Again, however, we have a number of indigenous plants, which are counted only as weeds, but which are really nice when

cooked as spinach. In the first place there are several indigenous species of *Amarantus*, including *Amarantus viridis* as well as *Amarantus spinosus*, which is considered such a noxious weed in Hawaii, the leaves of both of which make excellent spinach. *A. viridis* is known in many of the West Indian islands as 'Green Callalu.' In the Flora of Jamaica by Fawcett and Rendle, which is now being published, it is stated that not only do the leaves of *A. paniculatus*, a cultivated garden species, known as Bleeding Hearts make good spinach, but that the young stems are as good as asparagus. It certainly is a very rapid grower. The best spinach, however, of all the *Amaranth*s is afforded by the young plants of Cocks-Comb—the garden plant (*Celosia cristata*.) Sow a bed thickly with the seed, and cut the plants when about 4 to 5 inches high, and you will obtain spinach worth eating. Another *Amaranth* the leaves of which make a good spinach, is *Euxolus oleraceus*, which is called 'Lumbo,' in the Virgin Islands. The genus *Cleome* is widely spread throughout the West Indies; one species (*C. pentaphylla*), common in the Virgin Islands, and known there as 'Massambee', makes a good spinach, but another species (*C. pungens*), very much like the former, is most disgusting in flavour and odour. Another not uncommon weed 'Papa-lolo' in the Virgin Islands, 'Widi-widi' in Antigua—known botanically as *Corchorus siliquosus*,—makes a very delicate spinach. It is however rather difficult to prepare on account of the smallness of the leaves, which have to be plucked from the fibrous stalk.

Then there are the leaves of the tannia or eddoe plants; all of the species, to whichever genus they may belong—*Colocasia*, *Xanthosoma* or others—afford excellent spinach if used before they are too old, the unopened leaf-buds being especially delicious.

There is one other spinach, left to be mentioned last, the very poetry of spinach, and that is the male flowers of the pumpkin or squash. Where there is a large pumpkin vine dozens if not hundreds of male or staminate flowers open every morning. They are of no use, once the female or pistillate flowers have been pollinated. Pick them, and cook them, and you will agree with the writer that you have eaten the quintessence of spinach.

C.H.B.

TOMATOES.

In the issue of this Journal, No. 402, September 22, a short article appeared on the cultivation of tomatoes. Since then we have been favoured by a well-known grower of this fruit in Barbados with a few notes on the subject which are of much interest.

He says in reference to the degeneration in the size of the fruit when locally produced seed continues to be planted, that he has successfully overcome this tendency by planting cuttings. He has grown in this way splendid fruit for thirty years from the same original stock, so that his experience in the matter is to be relied on.

His advice is to put in cuttings in prepared beds in September, and at intervals for some weeks afterwards, in order to obtain a succession of fruit. These cuttings ought to be fruiting in the following December and January. If seeds are planted at the same time as the cuttings, the seedlings will produce fruit before the cuttings.

He finds that successful production of the best kind of tomatoes can only be achieved in the drier season of the year. Plants grown during the wet season attain large proportions without bearing; when they produce flowers these are almost always shed soon after the withering of the petals, and no fruit is matured.

PLANT DISEASES.

The following is the concluding part of Mr. Nowell's report, the first part of which appeared in the *Agricultural News*, No. 404, October 20, 1917:—

THE CRITICAL PERIOD IN THE DEVELOPMENT OF YOUNG LIME TREES.

In company with the Curator, I inspected the lime experiment plots in the valley behind Morne Bruce. The plots at the head of the valley are at present in a very interesting stage. Their history is given in the recently issued Dominica Report, 1916-17, pp. 48-9. The trees were planted in July 1913 on land which had been used for provision grounds for many years, and had then been for some time abandoned. They are spaced 20 × 20 feet. For the first two years the trees made excellent growth, without manure. The plots were weeded when necessary, and the trees were sprayed regularly to keep down scale insects. At the beginning of 1915 spraying was discontinued, in order to see how far the means of natural control would be effective. During the year scale insects of several species became very abundant on the trees, and their development was seriously checked. Many of the trees died back to near the base, and some were killed outright. The Curator, in reporting the existence of this condition, described it as familiar in his experience of the course of establishment of lime fields in the coastal districts of Dominica. The remedial treatment given to the plots, towards the end of 1915, consisted in a thorough draining, forking, and the application of a small quantity of lime, and then of organic manure at the rate of 2 lb. per tree. Spraying was not resumed. I inspected the plots in March 1916, before this treatment had taken effect, and made their condition the subject of a memorandum then submitted. The condition of the plots at the present time is astonishingly good. There are traces remaining here and there of the scale infestation and its effects, but on the whole, the trees are in vigorous health, and have grown so rapidly that they are now well ahead of what one expects to see in 4-year limes which have had no check at all.

The result attained can only be attributed to the draining, cultivation and manuring carried out towards the end of 1915. The shelter-belts then planted are not sufficiently developed to have contributed to the result, and the rainfall was abundant during the periods both of failure and of recovery.

In the memorandum referred to above it was pointed out that the reason commonly given for the relative freedom of citrus trees in Dominica from scale-insect infestation, namely, that it is due to the control exercised by fungi parasitic on the insects, does not adequately account for the observed facts.

During the period of severe infestation of the plots just described, the established trees on the manurial plots closely adjacent remained comparatively free from scale, and suffered no injury, even in the case of the no-manure plot, which received cultural attention only. In the period of the recovery of the infested plots there is no reason to believe that the conditions were any more favourable to fungus control than during their decline. Even in a forest district with a high rainfall, where the fungi are particularly favoured, the same difficulty has been experienced in establishing limes on ground from which the original fertility had been

removed by exposure and the cultivation of provisions. It seems clear in these cases that the determining factor is nutrition: that ill-nourished trees, especially during the period of their vegetative development, are in a condition which favours infestation with scale insects, while on well-nourished trees, the insects, when they are present, remain few in number, and do no appreciable harm. The term natural resistance may conveniently be used in this connexion, though whether the character on which it depends is a positive or a negative one I do not know. The effect may be seen illustrated over a wide range of plants in their relation to scale insects, and has been described in connexion with cacao trees and thrips by successive entomologists of this Department.

It is well known and forms the basis of an accepted practice, that young lime trees can be nursed up to bearing age without suffering such a check as has been described, by enclosing them in a shelter crop. Sugar-cane and various other plants, including the weeds and bush natural to the situation, have been used for this purpose. The effects of such treatment are exemplified in the experiments under notice by the plots grown in *Tephrosia candida*. To quote from the Curator's report: 'The difference in growth in the plot in *Tephrosia* when compared with the grass plot is most remarkable. The trees in the former plot are now 8 to 10 feet high, and are comparatively free from scale insects. The trees of the plot in grass are very liable to attacks by scale insects which require repeated sprayings to keep them down. Their average height is from 4 to 5 feet.'

If the effect of shelter were attained simply by the encouragement of the fungus enemies of scale insects, we should not expect to see any considerable difference in the growth made in the sheltered and open plots, since scale has been kept down in the latter by spraying. It is clear from this experiment, the results of which coincide with general experience, that close shelter greatly accelerates growth. My opinion is that the increased vigour of the trees so attained is in itself a sufficient protection against scale-insect infestation.

The Dominica experiments have confirmed and clarified certain conclusions, hitherto based on scattered and somewhat indefinite observations, concerning the growth of young lime trees. The matter may now be stated with considerable certainty as follows:—

A. Young lime trees from the time they are set out to the time of bearing, or as it would perhaps be preferable to state it, to the time when they are closing in and affording each other shelter, are liable to be held back, or to suffer severe checks, from infestation with scale insects. This liability is the greater as the situation is more open and the soil is more depleted: in particularly well-sheltered situations, and in ordinary situations where the soil is rich in humus, the condition does not appear. An abundant supply of rain does not in itself prevent its appearance.

B. The condition can be successfully met, and can by timely action be prevented in the following ways:—

(a) By the artificial control of scale insects by regular spraying. This measure simply prevents injury to the plants.

(b) By the provision of close lateral shelter. This measure greatly forwards the growth of the plants, which at the same time remain free from serious infestations of scale.

(c) By the manuring and careful cultivation of the plants in the open field, provided that the situation is not badly exposed.

In these experiments the development secured by methods (b) and (c) is so greatly superior to that obtained by method (a) as quite to eliminate the latter from recommended practices. The shelter method is the simplest, but,

for good results, care must be taken to keep clear around each tree a space just sufficient for its full development. Removal of the shelter will thus be gradual. Anything approaching overhead shade should be avoided. In applying the third method, the more shelter in the way of wind-breaks and hedges is provided, the less will be the attention required to maintain the vigour of the trees.

The conclusion drawn from these experiments with regard to natural resistance to scale insect infestations are applicable to mature trees but under Dominica conditions these are rarely severely attacked.

MOTOR TRACTORS.

In view of the present conditions of agriculture, and still more perhaps of future conditions when the war is over, the following article taken from *Occasional Notes*, No. 2, July 1917, published by the Royal Agricultural Society of England, is of interest. The article is written by the Society's Consulting Engineer, Mr. F. S. Courtney, M.I.C.E.:—

'The subject of motor tractors must, at the present time, seriously occupy the attention of most agriculturists, and under ordinary conditions (when intending purchasers might be considering the selecting of a tractor to meet their requirements) a general description and criticism of such tractors as are in the market might be of a useful guide. . . .

'Of such tractors there is a great variety, and as each one varies very considerably in design, it is evident that—even with American tractors—there is at present no unanimity of design.

'In evidence of this one has only to look at their framing, and the disposition and number of their wheels, some being 3-wheeled, while with the 4-wheeled there is an ever differing variety in their disposition, width, and diameter.

'Then, there are marked differences in the engines and gears; these, however, need not be considered at the moment.

'I have not the slightest doubt but that the prospective large application of motors to be used immediately in the development of arable land in this country will, within twelve months of their being set to work here, result in a very material modification, certainly with those makers who desire to maintain their footing in the English market.

'For these reasons I do not think it desirable to go into any critical examination of tractors in their present form or of their probable modifications. It is much safer to "prophesy after the event" and there is, no doubt, much which we shall learn by their extended use, and which will clear up some vexed questions.

'Perhaps the first of these is the weight of the tractor itself. On the one hand, weight is reduced to a minimum so that a tractor is produced weighing little over a ton with its full complement of oil, etc.; while, on the other hand, there are advocates of caterpillar tractors weighing thirteen or fourteen times that weight. How far the distribution of weight over a greater area of bearing surface is effective can only be definitely decided by a comparison of the crops grown on similar soils, but tilled with machines of varying weight.

'Apart from the class of tractor referred to above there is the combined tractor plough, which certainly should not be lost sight of. With either a plough or cultivator the implement is capable of doing a large amount of excellent work, and is especially adapted for irregular-shaped or small fields. In order, however, to get the maximum effect out of such a machine, it would appear essential that the driver should not have to follow and steer it, but that he should have a seat on it, with all the controls brought close

to his hand, and each capable of easy regulation. In this way he should be able to get nearly double the work out of his machine that he would by following it.

'The task of placing some thousand of tractors on the land within a short period is an immense one, and it would be expecting too much that the organization of the same should at first be perfect.

'It will be interesting to follow and note the modifications which will, as a consequence, be made in the machines.

'The omission of steam cultivation from the above must not be taken to assume that I consider it superseded by the motor tractor; on the other hand, given large fields and sufficient area to plough, no better work can be done than by steam.'

ANNATTO DYE.

Some years ago the Imperial Commissioner of Agriculture for the West Indies gave attention to the question of preparing the colouring matter from annatto seeds, and discovered a simple process for the purpose. He found that the colouring matter is easily removed from annatto seeds by washing them in a dilute solution of ammonium hydrate. The solution is strained off from the seeds and evaporated to a thick paste in steam-heated pans, when it yields an annatto paste of greater brilliancy and colour than that obtained in the usual way.

The great simplicity of this process would permit of its being carried out in places where annatto is grown, so that the concentrated paste might be shipped instead of the somewhat bulky seeds.

Considering the shortage of dye-stuffs, the Commissioner brought this matter to the notice of the Colonial Office in February this year, suggesting that it might be well to submit the idea to the Inventions Board, as of possible use at the present moment. The Department of Scientific and Industrial Research was consulted in the matter, and it has intimated that annatto is now chiefly used for colouring butter and cheese, and only to a very small and unimportant extent in dyeing.

Annatto is grown hardly anywhere in the West Indies to any extent, except perhaps in Jamaica, which still produces a small quantity. Should there be any future for this dye, and the cultivation of the plant extended, it would be an easy matter in carrying out the process suggested, to treat the annatto seed with ammonia and water in rotating churns, to strain off the liquid, and evaporate this to a paste in steam-heated copper pans, so that a factory for the purpose would be a simple affair. The residual seeds might possibly be used for oil production, and for cattle food.

A telegram from Amsterdam, printed in *The Times* for August 20, 1917, states that the Union of German Sugar Industry has stated to the German Chancellor that the Union desires the continuance of the Brussels Convention after the war, on condition that England shall agree to it. It is pointed out that England during the war has mainly used colonial sugar. It is of importance therefore to the German industry that cane and beet sugar should be placed on an equality as regards their import into England, so that colonial sugar may not permanently exclude beet sugar from the British market. This seems to be either a confession of weakness on the part of the German sugar industry, or an instance of German insolence.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, September 6, 1917.

ARROWROOT—5½d. to 6½d.
BALATA—Block, no quotations; Sheet, 3/9.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, no quotations; Jamaica, no quotations.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—Bananas, no quotations; Oranges, no quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, no quotations.
LIME JUICE—Raw, 2/6 to 2/9; concentrated, £30; Otto of lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—2/- to 2/3 per lb.
NUTMEGS—1s.
PIMENTO—3½d. to 3¾d. per lb.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., October 18, 1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.75 to \$13.25.
COCO-NUT OIL—No quotations.
COFFEE—Venezuelan, 12c. to 14c. per lb.
COPRA—7½c. per lb.
DHAL—No quotations.
ONIONS—\$8.00 per 100 lb.
PEAS, SPLIT—\$12.00 to \$12.50 per bag.
POTATOES—English, \$4.50 to \$5.00 per 100 lb.
RICE—Yellow, \$10.50 to \$11.75; White, \$9.25 to 9.50 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., October 16, 1917.

CACAO—Caracas, 12½c. to 13c.; Grenada, 12½c. to 12¾c.; Trinidad, 12¾c. to 13c.; Jamaica, 10¾c. to 10½c.
COCO-NUTS—Jamaica and Trinidad selects, \$52.00 to \$58.00; culls, \$36.00 to \$40.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—17c. to 20c. per lb.
GOAT SKINS—Jamaica, 65c. to 70c.; Antigua and Barbados, 60c. to 65c.; St. Thomas and St. Kitts, 55c. to 60c. per lb.
GRAPE FRUIT—Jamaica, \$3.75 to \$4.50 per box.
LIMES—\$4.50 to \$6.00 per brl.
MACE—38c. to 42c. per lb.
NUTMEGS—19c. to 20c.
ORANGES—\$2.75 to \$4.00.
PIMENTO—6c. to 6½c. per lb.
SUGAR—Centrifugals, 96°, 6.90c; Muscovados, 89°, 6.64c.; Molasses, 89°, 5.88c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 2, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$10.50 to \$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MOLASSES—No quotations.
ONIONS—\$9.00.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$8.25 to \$11.20
RICE—Ballam, \$10.50 to \$11.20 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, \$6.50.

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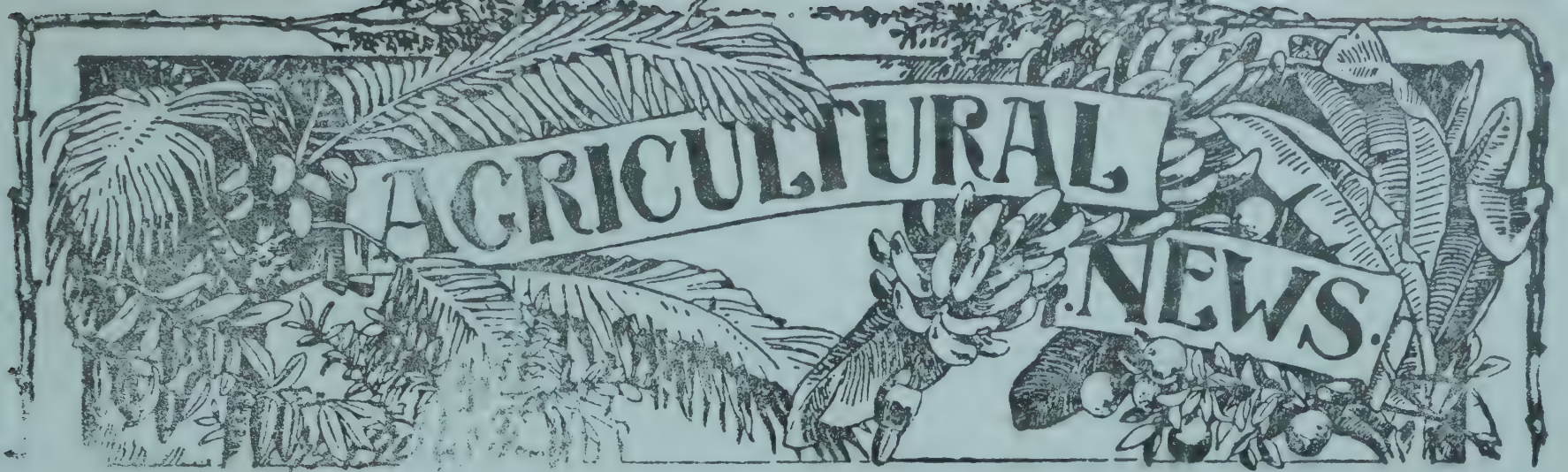
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Stimulation of Interest in Education.

THE appointment by the Administrator of St. Lucia of a Commission, to enquire into and report on the Educational System of the colony, and to make recommendations for its improvement, is calculated to initiate a move of much importance, the effects of which may extend far beyond the colony in which it originates. It is evident that a full and untrammelled examination of the situation is desired, for, in his covering letter addressed to the Chairman of the Commission, Mr. Lobb writes: 'I desire that the recommendations of the Commission shall be framed solely with a view to the needs of popular education, and *not* to the probable ability or

otherwise of the Public Treasury to meet the increased expenditure which must inevitably accompany any real improvement in the present system. It will then be the business of the Government to consider how far the financial resources of the colony can be made available for that purpose.' This indicates a wide outlook, and the intention to consider carefully and critically the report of the Commission before action is taken in regard to it. It seems evident, therefore, that the report of the Commission is to be regarded as only the first stage in this movement.

The terms of reference of the Commission are exceedingly wide, embracing consideration of the various aspects of primary and secondary education, the remuneration and qualification of teachers, the health of the pupils, the subjects taught, and many other matters.

Naturally, special reference is made to teaching in regard to agriculture, the Commissioners being directed to advise concerning the teaching of 'the elementary principles and practice of agriculture, which is the basis of the colony's prosperity.'

With so important a Commission in operation, it will be useful to draw attention to some of the efforts that have been made by the Imperial Department of Agriculture to assist and encourage the teaching of agriculture, throughout the West Indies.

Reference to the pages of the published volumes of the *West Indian Bulletin* and of the *Agricultural News* will serve to show the very considerable amount of attention that has been devoted to this question of agricultural education during the period in which the Imperial Department of Agriculture has been in existence. The reader is referred especially

to the *West Indian Bulletin*, Vol. I, pp. 77-108 and pp. 229-66; Vol. II, pp. 97-130; Vol. VI, pp. 197-233; Vol. VIII, pp. 280-312; Vol. XI, pp. 439-47; and Vol. XIV, pp. 172-80.

Reference may more particularly be made to Vol. XI, p. 439, where a brief summary is made of departmental efforts in this connexion up to 1911. It will there be seen that assistance has been given in respect to many phases of education, and not only in regard to agricultural instruction in primary and secondary schools. Aid has also been given to encourage the teaching of elementary principles of agriculture in the primary schools by giving instructions to the teachers of such schools, and by the production of text-books especially suited for local use. It is noted in this article that:—

'The following courses of lectures or classes for teachers have been given. In many cases they were accompanied by demonstrations and practical work conducted at a botanic or experiment station, and in these instances their value was considerably enhanced:—

Grenada, 1900 (two courses) and 1903.

St. Vincent, 1904-5.

Barbados, 1898, 1899, 1900, 1901, 1902-3.

St. Lucia, 1899, 1900, 1901, 1903, 1909.

Dominica, 1900, 1901.

Montserrat, 1900, 1901, 1902, 1906.

Antigua, 1900-1, 1901-2, 1903-4, 1904-5, 1905-6, 1906.

St. Kitts, 1902, 1903.

'In order to aid the teachers in their work, a small hand-book entitled "Nature Teaching" was prepared, with the object of providing a simple outline of scientific studies having an agricultural bearing, and at the same time indicating various pieces of practical work and experiments capable of being carried out by the teacher or his pupils, and affording directions for accomplishing this. In the Leeward Islands, again, a pamphlet entitled "Hints to Teachers" was prepared, for the purpose of assisting in the instruction detailed in the syllabus of science and nature study, in the code governing the elementary schools of the colony; this has been embodied to a large extent in "Nature Teaching" in connexion with the successive enlargements that this work has received in recent years. Further, in the Pamphlet Series, several issues have been made of a publication entitled "Hints for School Gardens", the scope of which has been greatly increased in the new editions. A small work dealing in a simple manner with Tropical Hygiene has also been prepared for

the Government of the Leeward Islands. It must be mentioned lastly, although this is not one of the publications of the Department, that a booklet having the title "Suggestions for School Gardens" by J. P. Williams, M.A., has been published by the Jamaica Board of Education.'

+ In treating the question of agricultural education, it is worth while to try and obtain a clear idea of the position of the pupils, and their requirements.

As regards such education given to the scholars in elementary schools, both critics and well-wishers are often disposed to consider that the method of instruction should be purely utilitarian. Most of these scholars are likely to earn their future living as agricultural labourers it is said, therefore teach them to handle the fork and the hoe and such like things, and they will turn out good labourers, able to maintain themselves and fill a useful position in their country. Now this is really not fair, either to the scholars or to the teachers of elementary schools. All that can be expected is that the elementary facts of agricultural life should be taught and made familiar to the children, especially by training their powers of observation. To expect the scholars of an elementary school to leave school as expert labourers, is to expect the elementary school to fulfil the functions of a technical school, and the teachers to be expert planting overseers.

Too much stress cannot be laid upon the necessity of training the powers of observation of the scholars in elementary schools in the West Indies. Most of our children here have excellent powers of memory, but their observant faculties seem sadly lacking. They can learn by rote pages of a text-book, especially of a catechetical kind, but they do not seem, except in rare instances, to observe differences or likenesses in the objects of plant or animal life with which they are in continual contact.

In is in this particular that the agricultural education in elementary schools in the West Indies seems largely to have failed. In spite of the excellent text-books referred to above, adapted to local conditions; perhaps indeed because of them, very little real knowledge of the matter seems to be freely attained by the pupils. That is because the teacher, and let us say the examiner also, is often content with glib, parrot-like repetition of answers derived from the books. Direct observations of the actual plants, tools, and appliances are necessary to good teaching: in most country districts in the tropics there is no difficulty in gathering from around the school

the necessary objects to illustrate practically every lesson in agricultural matters.

In fact the only schools in the West Indies in which agricultural education seems to have improved in the last ten years are those where the examining, and consequently the teaching, has been at least to some considerable extent, directly out-door and practical. St. Lucia may be mentioned as an honourable example. There the agricultural education in elementary schools seems to be bearing good fruit, because the officers of the Agricultural Department visit and advise on the school gardens from time to time, and conduct examinations connected therewith.

The following quotation from a paper by the Imperial Commissioner in the *West Indian Bulletin*, Vol. XIV, p. 172, puts what may be considered as fair to expect to be taught of this subject to the average child who is to become an agricultural labourer:—

'They may well be taught elementary facts about plant and animal life, about the manner in which seeds germinate and plants grow, and the fundamental relationships of plants to the soil and air. They may also be trained in certain simple operations, such as the sowing of seeds, the propagation of plants by cuttings, and perhaps such operations as budding and grafting, and these exercises may—and it is very desirable that they should—extend to simple operations conducted in a school garden, where the pupils may learn something concerning the handling of soil, the arrangements necessary for the cultivation of simple crops, probably principally of culinary vegetables, and of the various incidents requiring the attention of the cultivator in order to bring these crops to maturity, such matters as watering and the protection of the crop from insect pests, all of which, if judiciously handled by the teacher, afford rich stores of material of educational value, and enable, even in simple minds, an appreciation to be arrived at of the fundamental facts in the life of a peasant.'

'More than this it does not seem necessary to look for or expect; indeed if it is carefully looked at, it will be seen that it really embraces a wide range, having regard to the child mind, and what is more, it admits of being carried into effect in practically every agricultural district, and so demands no educational revolution or upheaval.'

Reference will be made in a future number of this Journal to the work done in connexion with secondary schools, and with regard to the teaching of agricultural subjects from a technical point of view.

THE GOVERNMENT EXPERIMENTAL ESTATE IN TRINIDAD.

The Government of Trinidad own and work as an Experiment Station, under the control of the Agricultural Department, the River estate, in the Diego Martin district. On the occasion of a visit to the estate by the Sangre Grande District Agricultural Society, Mr. W. G. Freeman, the Acting Director of Agriculture, gave a résumé of the history and present position of this Government property. The *Port-of-Spain Gazette* for October 27, 1917, gives a report of Mr. Freeman's speech, from which are gathered the following interesting details.

Mr. Freeman said that the Government had bought the property in 1897 for £4,629, and had since spent large sums on improvements, which made up a total capital expenditure of £11,274. The present position of the estate was that it had paid back to the Government the whole amount spent on its purchase, and it had a small balance in the bank. There were about 120,000 bearing cacao trees, and 10,000 were in the hands of contractors, and with timber, limes and other things, there were about 400 acres under cultivation. The estate could easily be valued at £25,000. The timber contracts were fairly well taken up, there being thirty-eight contractors. There were some 5,000 coffee trees also planted on the estate. In referring to the labour question, Mr. Freeman remarked that the River estate had its labour difficulties as the other estates, but it was helped to a certain extent by the work of the boys of the Reformatory, which, he was glad to say, was generally speaking, good. The boys did cutlassing and brushing. Owing to the increase in the cost of living, deserving labourers had had their wages increased. But the great thing was a want of a regular labour supply. Following the practice obtaining at Caroni and Palmiste, River estate now gave a bonus of one day's pay at the end of every fortnight to every labourer who worked for ten days in that fortnight. Much success had been achieved. In many ways, the estate spent much money in ways not called for on private estates.

Two branches of the experimental work of which Mr. Freeman spoke seem of special importance, viz., the selection of cacao beans for planting, and the series of manurial experiments. He said that as regards the first, planters had recognized that all cacao trees did not bear alike, but there was very little definite information on the subject. Professor Carmody started a big scheme of numbering selected trees to get returns year by year of what each bore. At present, there were 10,000 trees thus labelled. Yields were recorded for some five years now, and by comparison they could tell that a tree was a heavy bearer if it always bore heavily. Seeds from such heavy-bearing trees were used for propagation purposes; and pods from these selected trees were also sold to planters. Seedlings might not always turn out like their parents, because there was the possibility of crossing. But by means of grafting or budding one could make sure that one had a really heavy bearer. Many people doubted the value of such records, on the ground that heavy bearing might be due to accidental differences in soils. But in California, U.S.A., similar experiments were conducted with grape fruit, with similar results.

With regard to manurial experiments, the estate also had a large series of manurial experiments, and from general results at present it was gathered that bigger yields were got from manured than from control plots. But on the question of manures, the ordinary planter had also to consider the financial side. The estate was run as a commercial concern, and its great value was what they could learn from it.

SUGAR INDUSTRY.

REVIEW OF THE WORK OF TWO WEST INDIAN SUGAR FACTORIES, 1917.

At the instance of the Directors of Gunthorpe's Factory, Antigua, and Basseterre Factory, St. Kitts, the results of the working of these factories for the past season have been furnished to the Commissioner of Agriculture. The following information based on these reports is calculated to be of much interest and value to those concerned with the manufacture of West Indian sugar.

The Antigua factory manufactured 11,705 tons of sugar from 102,601 tons of canes, the St. Kitts factory 11,843 tons of sugar from 93,372 tons of canes.

It is satisfactory to note that the megass was more than sufficient for the complete manufacture of the sugar at the Antigua and St. Kitts factories; very large surplus amounts remained on hand at the close of the season.

The work of these factories has been extremely good during this season, that of St. Kitts leading slightly; this factory had a better quality of cane to deal with.

The main features of the factories' work may be gathered from Table I.

Table II shows the recovery and losses of sucrose.

The average composition of the cane dealt with, calculated from the data supplied, is given in Table III.

TABLE I.

	Gunthorpe's, Antigua.	Basseterre, St. Kitts.
Cane crushed, tons	102,601	97,372
Juice 'diluted'	90,876	89,653
Juice 'undiluted'	74,170	75,037
Juice expressed per 100 parts of juice in cane: or sucrose extracted per 100 sucrose in cane	93.03	94.4
Sucrose in juice, tons	12,379	12,307
Commercial sugar made, tons	11,705	11,843
Purity diluted juice	84.78	85.50
Sucrose in 100 cane	12.97	13.39
Fibre in 100 cane	17.43	14.37
Sucrose in 100 megass	2.66	2.60
Juice in megass per 100 fibre	31.0	31.7
Juice lost per 100 cane	5.41	4.55
Recovery commercial sugar on 100 sucrose in juice	94.6	96.2
Recovery of sucrose on 100 sucrose in juice	90.87	92.24
Commercial sugar made per 100 sucrose in cane	87.95	90.84
Calculated to 96° sugar	88.04	90.71
Sucrose in above per 100 sucrose in cane	84.52	87.08
Tons cane per ton commer- cial sugar	8.76	8.22
Polarization, sugar made	96.10	95.85
Molasses, Imperial gallons	619,515	—
Molasses, per ton of sugar	53.0	—

TABLE II.

PER 100 PARTS OF CANE.	Gunthorpe's, Antigua.	Basseterre, St. Kitts.
Sucrose recovered in sugar	10.96	11.66
Sucrose lost in megass	.90	.75
Sucrose lost in press cake	.07	.06
Sucrose lost in molasses and unrecorded	1.04	.92
	12.97	13.39
PER 100 PARTS OF SUCROSE IN CANE.		
Sucrose recovered in sugar	84.52	87.08
Sucrose lost in megass	6.97	5.60
Sucrose lost in press cake	.50	.41
Sucrose lost in molasses and unrecorded	80.1	6.91

TABLE III.

COMPOSITION OF CANE.

	Antigua.	St. Kitts.
Sucrose	12.79	13.39
Glucose	1.00	.76
Non sugar	1.36	1.64
Fibre	17.43	14.37
Water	67.42	69.84
	100.00	100.00

The character of the work done may best be appreciated by comparison with the work done in the best factories in other countries. The principal factor in determining the work of the factory is the efficiency of the mills. Gunthorpe's mills extracted 93.03 per cent. of the sucrose in the cane, and Basseterre 94.4. It is stated that the average work of the mills in Java in 1915 is represented by an extraction of 90.2 per cent. of the sucrose in the canes, while in Cuba the average is stated to be about 91 to 92 per cent. What is possibly the most efficient mill there is stated to have secured 94.68 per cent. of the sucrose in the cane in 1915. The mill work in Hawaii is probably the most efficient in the world; in 1914 the average percentage of sucrose extracted is stated to have been 95.4, while in 1915 the range reported from forty-three factories was from 90.5 to 97.68: this latter figure probably represents the high-water-mark attained so far in mill work.

It is a point to remember that the extraction of sucrose from the cane is influenced by the amount of fibre that the cane contains, though the disability of high fibre content is now largely met by the judicious employment of maceration water. In Hawaii the amount of fibre in the cane averages about 10 per cent.; the canes dealt with at the factory referred to as recovering 97.68 per cent. had a fibre content of 12.15 per cent. In Cuba the fibre content varies from about 10 to 14 per cent. In Java it averaged 13.14 in 1916. It will be observed that the mills at Antigua and St. Kitts were at a disadvantage in this respect, and abnormally so in the case of Gunthorpe's.

The recovery of sucrose from the sucrose in the juice that is to say, the work of the factories subsequent to the mills, was good at St. Kitts, being 92.24 per cent.; it was less efficient at Antigua, where it was 90.87; the juice at this factory presented difficulties in working.

The recovery in the form of sucrose in the sugar sold was at Antigua 84.52 per cent., at St. Kitts 87.04. The figure for St. Kitts is extremely good, and that at Antigua satisfactory. The range in 1915 for the two principal factories in Cuba was from 78.3 to 84.59.

It is interesting to note, though this point has not the importance often attached to it, that Gunthorpe's factory in this season took 8.76 tons of cane per ton of commercial sugar, and Basseterre 8.22. In Hawaii the average in 1915 was 8.14 tons; in Cuba 8.68 tons.

The foregoing survey of the work of the past season shows that the character of the work at Antigua and St. Kitts, concerning which comparisons were made last year in this Journal (Vol. XVI. p. 356, November 4, 1916), has been well maintained; indeed some advance has been made at St. Kitts, in that the recovery of sucrose, in the form of sucrose in sugar shipped in 1917 reaches 87.08 per cent., whereas in 1916 it was 85.59. These figures may be compared with those of the two first years of Gunthorpe's factory, when the average was 64.74 and 64.56.

Judging by Hawaiian standards, it is possible to effect further improvements, and doubtless the Directors of these factories will consider whether or not it may be profitable to attempt them. In any case a high level of efficiency has now been reached in the smaller West Indian islands. It remains to see that it is at least maintained and, if possible, advanced.

F.W.

THE SUGAR MARKET.

The following information concerning the sugar situation is abstracted from the latest reports to hand of Messrs. Gillespie Bros. and Co., dated New York October 19 and 26, respectively:—

The interest in refined sugar furnishes a situation unparalleled in the history of the trade. Refiners are besieged with orders for any amount of sugar that can be secured, but, as previously reported, there is no possibility of satisfying even a small part of the demand, except in a very limited way.

Most of the refiners have withdrawn from the market, and there are now only two local refiners who are still taking business from regular customers, but with restrictions. Deliveries are still behind, and some cannot guarantee delivery within thirty days, while others are three weeks behind on city, and two weeks on country orders. Four of the largest refiners have closed down on account of the scarcity of raws, although they will reopen should they obtain sufficient quantities to warrant their operations.

On October 26, the report runs:—

The situation in sugar is still critical, and we have no business to report as far as Cubans are concerned, although the quotation still remains at 5½c per lb. c. & f., equal to 6.90c. per lb. duty paid. Within the past day or two some 2,500 tons of Philippine centrifugals afloat, and in transit by rail, have been sold at 6.90c. per lb. basis 96° c.i.f., and 7,000 tons of low grade Philippine sugar at 5.75c. per lb., basis 88° c.i.f. New York.

It is also reported that business has been concluded for 100,000 tons Louisiana raw sugars between the Louisiana planters and the Food Administration, on the basis of 6.35c. per lb. basis 96° f.o.b. New Orleans. All Centrals have now stopped grinding in Cuba, and advices from there report the weather is favourable for the growing crop.

Receipts to the Atlantic ports for the week were 12,710 tons against meltings of 25,000 tons, and the stock in

refiners' hands now totals 44,210 tons, which with 48,096 tons for the entire island of Cuba, makes a total of 92,959 tons against 269,028 tons in all hands at this time last year. From the foregoing, it will plainly be seen just how short we are of supplies, and in order to provide for the household and allied food needs, the Head of the Sugar Commission in Washington has thought it advisable to discontinue selling to confectioners, and syrup and cordial manufacturers, stating further that they probably will be licensed shortly, and their business reduced to a minimum.

Since writing the foregoing, it is reported that the Sugar Commission at Washington has finally concluded to allow confectioners to have 50 per cent. of their former sugar requirements until January 10. What course is to be followed after that time is yet to be promulgated.

A LIGHT MOTOR PLOUGH.

The question of the employment of motors for ploughing and other agricultural operations has been receiving attention of late in the pages of this Journal: reference may be made to pages 285, 339, and 351 of the present Volume.

Information has lately been received at this Office from the Secretary of the Food Production Department of the Board of Agriculture and Fisheries of Great Britain, that the Wyles Motor Plough is considered very suitable for orchards or small holdings. It has not been found successful on large farms. In the book 'Farming by Motor', which was reviewed on page 285 of the issue of this Journal for September 8, 1917, there is a description given of this motor plough with illustrations, from which we take the following particulars:—

'This is one of the early, single-cylinder, simple-type, self-contained motor ploughs built by the first people in this country (England) to devote serious attention to this type of machine. The weight of the machine being nearly balanced on the front axle, the ploughman (who walks behind and holds the handles as with an ordinary horse plough) is able to lift the plough clear of the ground for turning at the headlands. It is British made, and all parts are standardized and interchangeable.'

The following is a brief specification of its features:—

Engine—Single-cylinder, vertical, 11 b. h. p.

Transmission Gearing—Completely enclosed and running in oil, provides two speeds forward. No reverse necessary.

Wheels—2 feet 9 inches by 7 inches face.

Weight—Including double furrow plough, approximately 20cwt.

Dimensions—Over-all length, 12 feet 6 inches; over-all width, 2 feet 6 inches; over-all height 4 feet.

This motor plough, although perhaps not suitable for heavy cane land, might possibly do good work on light soils, and in the cultivation of cotton or onions. Such soils as those of St. Kitts and St. Vincent, for instance, seem to be capable of being cultivated successfully by a light motor of this type.

Full information can be obtained from the manufacturers, Wyles Motor Ploughs Ltd: 5 Carr Street, Manchester.

DEPARTMENT NEWS.

Dr. J. C. Hutson, B.A., Ph.D., Entomologist on the staff of the Imperial Department of Agriculture, left Barbados on October 31 for St. Vincent for entomological studies. He is expected to remain in that island for about a month.

SEA ISLAND COTTON MARKET

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending October 20, 1917, is as follows:—

ISLANDS. The receipts of the week were larger, and admitted of the Factors having better offerings. There was only a limited demand, and with a quiet market there was more disposition to sell. Sales of about 200 bales Fully Fine were made at 70c. taking a selection of the offerings of the odd bags, the buying being on account of the Northern Mills, but a bid of 68c. was refused for Fine.

We quote, viz:

Fine to Fully Fine 70c = 72c. c.i.f.

GEORGIAS AND FLORIDAS. There was an easier feeling in the market the early part of the week, resulting in sales in Savannah of about 500 bales on a basis of Extra Choice to Fancy at 68c., taking such offerings as were seeking sale. Towards the close of the week there was less disposition to sell, as the interior markets, were firmer and higher, and Factors refused to make further sales under Extra Choice to Fancy 70c.

The demand continues on account of the Northern Mills which seem to require some early shipments. Unfortunately freight room is scarce and difficult to engage, and there is also an embargo on certain New England points.

We quote:

GEORGIAS AND FLORIDAS.

Extra Choice to Fancy 68c. to 70c. = 70c. to 72c. c.i.f.

The exports from Savannah for the week were, to Northern Mills 25 bales, Southern Mills 43 bales, and from Jacksonville to Northern Mills 1,683 bales.

CROP ADVICES. The reports from the country continue to confirm the damage done in certain sections by the boll weevil, and the recent unseasonable cool weather has interfered with the development of the plant in other sections. Consequently the disposition is to reduce crop estimates, which now range from 85,000 to 90,000 bales.

THE BRITISH COTTON GROWING ASSOCIATION.

The One Hundred and Sixty-fourth Meeting of the Council of the British Cotton Growing Association was held at the Offices, 15 Cross Street, Manchester, on Tuesday, October 2.

In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.), Mr. James Brown occupied the Chair.

WEST AFRICA. With the exception of about 200 bales of cotton grown in the Meko district, all the cotton which has been purchased in Nigeria this season has been received in Liverpool.

Efforts are now being made to ship as much cotton seed as possible before the new crop begins to come in. The Association have about 5,000 tons of this seed, but in the event of shipping facilities not being available, the bulk of it will have to be destroyed, as there is very little demand for the seed locally.

A report was read from the Resident of the Sokoto Province, Nigeria, dealing with the large development which took place in cotton growing during the year 1916. The Resident states that in former years all the cotton grown in the Sokoto Province, after supplying local needs, was exported to the French Sudan. In the season 1915-16 the usual

buyers from the North failed to appear, and at the same time the shortage of specie made it imperative for farmers to find some means of paying their taxes. The Association were buying cotton at their ginneries at a good price, and so the transport of cotton to Zaria began, and increased very rapidly. The Sokoto Zaria road was for weeks filled with donkeys, camels, oxen, and men carrying cotton to Zaria. Sellers were pleased with the price realized, as being much higher than that formerly received. The Resident concludes that the growing of cotton has received a great stimulus in all the eastern half of the Province, and states that up to the time of his report the rains had been unusually good.

The purchases of cotton in Lagos to August 31, amounted to 7,703 bales, as compared with 9,134 bales for the same period of 1916, and 5,748 bales for 1915.

The purchases of cotton in Northern Nigeria to August 31, amounted to 3,713 bales, as compared with 10,522 bales to August 31 last year, and 531 bales in 1915.

NYASALAND. It was reported that arrangements had been made for a special allocation of 500 tons of space by the steamship lines for the monthly shipments of Nyasaland produce from Beira or Durban. This space, however, is only available if the tonnage is not actually in excess of the priority cargo arranged for each given month, so that it is not possible to say how much space will be available for cotton. At the same time it is considered that this concession will be of great assistance in dealing with Nyasaland cotton during the present season.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

TORTOLA. During the month of September the following plants and seeds were distributed from the Botanic Gardens: sweet potato cuttings, 500; cabbage plants, 12; cotton seed, 144lb. The condition of the cotton and food crops in the island, Mr. W. C. Fishlock, the Curator, reports to be improving, the weather recently having been more favourable. There has been an increased demand for cotton seed since the alteration in the mode of buying cotton, namely, making the first payment 12c. instead of 5c. No serious pests on cotton or provision crops were reported. The weather was squally towards the 21st. Rain fell in measurable quantity on twenty days, the total precipitation being 4.36 inches as compared with 4.90 inches, the average for the same month for the previous sixteen years.

BARBUDA. From a report by Mr. C. A. Gomez, Agricultural Instructor, forwarded to this Office by Mr. A. E. Collens, Acting Superintendent of Agriculture, Antigua, the following matters of interest concerning the Government estate, Barbuda, are abstracted.

The general condition of the crops and of the stock is reported as satisfactory.

Work of a routine nature, consisting in keeping cotton fields clean of weeds and grass, and supplying dead holes, comprised the chief activities during the month. In the early part of September about 10 acres of cotton were planted, and notwithstanding the poor rainfall, very fair germination was obtained. At the time of writing the Government's cotton crop presented a fine appearance, and the prospects of a good return are very hopeful. No insect pests of cotton have been reported, but towards the end of the month the presence of internal boll disease was discovered, and specimens of the infection were forwarded to the Head Office.

Plant distribution at the Experiment Station included 5,000 sweet potato cuttings and 25 lb. cotton seed. In

regard to the results obtained with plot experiments, attention is directed to two $\frac{1}{10}$ -acre plots of corn, each of which gave a yield of 200 lb. grain, or at the rate of 35 bushels per acre.

September was conspicuous by the absence of the customary torrential downpours. Rain fell in measurable quantity on six days only, aggregating a total of 3.4 inches. On September 20 and 21 very rough weather was experienced, and there were indications of atmospheric disturbance to the south-west.

Visits to the peasants' plots showed that the peasants were continuing their energies in planting and caring for their cotton and other crops, and an increased production of the corn and sweet potato crops was seen as a result of the advice given by the Agricultural Instructor in January last as to the necessity of planting more food crops. An official visit was paid to the island by the Acting Superintendent of Agriculture, who discussed with the acting manager various lines of activities in progress, and devoted much time to investigating the more important features of the island's industrial position.

AGRICULTURE IN BARBADOS.

The weather during the last fortnight of October was dry. The light showers which fell during this period remind us of those which occur in the month of April. Between the 18th and the end of the month hardly any gauge registered more than 1 inch, and in several districts the total was less than this.

There is a marked difference between this record and that for the same period during October last year. During the last two weeks of October 1916 there was a spell of wet days, when 6 inches of rain fell in the sea-board parishes, and as much as 13 inches in the centre and hilly districts of the island. In addition to this there were only eleven fair days in the whole of this month last year.

The total rainfall for the month now under review is between 9 and 10 inches in the northern part of the island not including St. Lucy, between 7 and 8 inches in the central districts, and between 4 and 5 inches in the northern and southern sea-board districts.

We think that, on the whole, the preparation for the planting season is more advanced than at this time last year. The weather has been more favourable for tillage, and there has been a regular supply of labour.

Potatoes continue to be hurried out of the fields required for the cane plants, and these are immediately ploughed or forked. The tillage of some fields presents a most pleasing appearance, and the drains recently opened are sometimes as straight as a plumb-line.

We have not seen much moulding done beyond surface moulding from drains. This may be due either to lack of sufficient labour or to the difficulty of finding material. We believe in scattering new mould on the brows of fields. The effect is immediately seen, and the soil in these spots for a few years afterwards gives a satisfactory account of itself. We are convinced that the present unsatisfactory condition of the cane crops in some red soil districts is due in some measure to insufficient tillage. The soil from year to year, after the growth of three or more crops, has not been ploughed and forked often enough, and the subsoil has not been sufficiently exposed.

Cane disease of a peculiar type is prevalent in some districts in Porto Rico, and those who know attribute it in a large measure to imperfect cultivation or, as it has been termed, 'rough-and-ready methods' of cultivation. Let this serve as a reminder to us that soil must receive the best and

most liberal treatment, if its resources are to be kept up, and our crops are to yield an abundant increase.

Everywhere farmyard manure is being applied to the fields soon to be planted, and each arrival of sheep manure is eagerly awaited. Twice, nay, three times the amount of this manure now available would be gladly welcomed. In several fields pens have been started during the past fortnight. These will not be ready before January.

At this period last year those who had plots of the new seedlings were offering them for sale at remunerative prices, but planters in general this year have a fair supply of the varieties they intend to plant. A deep rain is necessary before planting can be started, and we are glad to state that November has opened favourably.

The cane crop, on the whole, looks well. The recent dry weather has not as yet given the plant canes a set-back. The ratoons here and there in the drier districts have begun to lose their vigour, but even concerning them there is just now no real cause for anxiety. Where the canes are tall, and the earth well shaded, there is still a satisfactory supply of moisture in the soil.

We regret to say that the crop in general in the red soil will not be a large one. It is low in many instances, and is not possessed of that vigour, in the ratoon fields particularly, which will guarantee proper development. In some fields of ratoons yellow spots have further increased. As far as we have been able to observe, this is not due to any fungoid attack, but simply to lack of nourishment.

Potatoes are being sold at a lower rate than at the date of our last report. They are being disposed of by speculators at prices varying from 48c. to 60c. per 100 lb. These rates are not likely to be continued beyond January, when the catch crop fields will have been sold out. The return on black soil estates has been, as a rule, satisfactory.

Fall potatoes have been planted in very fair quantity all over the island, and with favourable weather during the next three months they should do well. Some care too has been taken with the cultivation, and they have made a good start.

A limited quantity of new yams and eddoes is being offered for sale, and the old crop is being sold at \$2.00 per 100 lb. The early yam crop will be a very moderate one, but the Lisbon yam crop promises well everywhere. Generally speaking, the nut eddoe crop is a very poor one. Owing, we believe, to a scarcity of plants, only a moderate area was put under this vegetable, and the fields that were planted have not grown with vigour. White eddoes have been much more largely planted than nut, and the fields are in good condition. (*Agricultural Reporter*, November 3, 1917.)

The Choco.—One of the most widely cultivated vegetables in tropical parts of the Western Hemisphere is the Choco (*Sechium edule*), well known in the West Indies. Its fruit is cooked and eaten in the same way as the vegetable marrow. The fruit is sometimes offered for sale in London, but it is doubtful if it is appreciated except by those who have made its acquaintance in the tropics. The plant can be grown successfully under glass in England. The *Field*, August 25, 1917, tells a story of a market gardener in Essex who devoted several green-houses to the cultivation of choco. He obtained a most satisfactory crop, but failed to make it sell, so that he lost heavily. This proves nothing but that the stay-at-home Englishman is most conservative in his food. Yet those who have eaten it are quite sure that the choco is a delicious and wholesome form of vegetable marrow.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial of this number refers to a question of great importance at the present time, the stimulation of interest in education.

On page 356 there is a review of the work of two sugar factories in the Leeward Islands for the season just ended, which will be found interesting and valuable for its statistical comparisons.

Insect Notes on page 362 describe the pink boll worm of cotton, fortunately not yet introduced into the West Indies.

The Corn Production Bill.

The Corn Production Bill has been one of the most important pieces of business to which the British Parliament has put its hand this session. The following are the chief provisions of the Bill to which the Royal assent was given on August 21:—

(1) Minimum prices for wheat and oats are fixed for six years.

(2) Agricultural workmen are guaranteed a minimum wage of 25s. a week.

(3) Rents are not to be raised in consequence of the passing of the Act.

(4) The Board of Agriculture are given the power to enforce proper cultivation.

As might have been expected, some of the provisions of the Bill were strongly contested, but the Government carried their point on every occasion. Not only does this seem to be the most important business carried through Parliament in this session, but it is of such far-reaching influence that it may be considered one of the most important Bills ever passed by the Parliament of the United Kingdom.

Rice Crop in British Guiana.

The yield of the rice crop this year is most disappointing, says the *Demerara Daily Argosy* for October 27, 1917. Instead of an average of 20 bags to the acre on the coast lands, the return in many instances is no more than half of this. From the West Coast, Berbice, it is reported that in some instances the farmers are getting only 6 bags to the acre. It is anticipated that on account of the poor returns the rice crop will be very considerably below what was expected. One cause suggested is attacks on the soft grain of the rice before maturity by a destructive fly, thus, although the cultivation may have a healthy appearance, there is little or no grain in the ripe ears.

In view of the fact that most of the smaller West Indian islands depend on Demerara for a large proportion of their supply of rice, this report is not encouraging.

Experimental Production of Oil from Rubber Seeds.

The *Board of Trade Journal*, August 2, 1917, has a note on the above subject which we quote below. If successful, a new source of oil supply will be found, and an increase in the profits from rubber plantations will doubtless accrue.

According to a communication received from the Malay States Information Agency in London, a preliminary enquiry into the possibility of the commercial utilization of the seed of the rubber tree for oil production has been undertaken by the agricultural authorities in the Federated Malay States. From time to time suggestions have been made for the utilization for this purpose of the seeds of the cultivated Para rubber tree, as large quantities of the seed go to waste on the rubber plantations of the Middle East. Experiments have proved that not only is the oil extracted from the seeds suitable for various purposes, but that the residue can be utilized for cattle food, or as manure.

In his report on agriculture in the Federated Malay States in 1916, the Director of Agriculture states that with the co-operation of a number of estate owners near Kuala Lumpur, who supplied seed at the cost of collection and packing, shipments aggregating 25 tons were sent to a Hull firm of oil seed crushers, who have undertaken to advise on the economic possibilities of the oil, and as to the plant necessary for its extraction. It is not considered that it will be economically possible to ship seed to the United Kingdom to be crushed there, but that one or more crushing plants might be established in the Federated Malay States. The oil would be shipped to the United Kingdom, the residue being used locally for cattle feeding or agricultural purposes. In order to test this proposition a motor has been ordered to complete the oil-crushing plant which was installed by the Department prior to the war, and it is hoped to carry out some experimental crushings on a commercial scale in the course of the present year. Investigations as to the effect of prolonged storage on the oil content, and on the acidity of the seed are also being made by the Department.

Banana Fibre for Bag Making.

The *Chamber of Commerce Journal*, for October 1917, publishes an article on banana fibre for bag making, which may be usefully reproduced in this Journal: 'According to an American commerce report, machinery has been brought to Honolulu from the State of Washington by four men who are making an investigation of the use of the fibre of the banana trunk for bag making. The investigation was brought about by announcements that the sugar planters of the Hawaiian Islands, as well as those of other sugar-producing countries, are faced with uncertainty concerning steady shipments from Calcutta of bags to be used as containers for raw sugar. Ever since bags have been used by the Hawaiian sugar planters in exporting the raw product from the islands to the mainland of the United States, the Hindu bags, which are made to contain 125 lb. each, have proved to be satisfactory. War conditions have caused the planters to cast about for a substitute. Among the substitutes that have been proposed is a barrel made of sugar bagasse. The keg or barrel of this material is rigid, and is not so easily or quickly handled or stowed away in the hold of a vessel as a bag. There would also be the additional expense involved in the return of the empty container, unless it was otherwise disposed of. The investigators find that the banana stalk fibre is of the proper quality, but they have also found that a large number of banana plantations comprise more or less the stubby plant sometimes known as the Chinese banana. The Bluefield banana was introduced into Hawaii about ten years ago, and is flourishing, but has not by any means displaced the stubby and sturdy Chinese type, which appears to be satisfactory to the growers, who are principally Chinese. The investigators, while not having completed their inquiries, are satisfied that the industry will be established in Honolulu.'

Red Pepper Trade of South India.

According to an article in the *Journal of the Society of Arts*, February 16, 1917, red peppers (chillies) are most frequently grown in the Presidency of Madras as borders to fields, or as lines through fields. The commonest form is *Capsicum annuum*, to which species the large long Capsicums belong. The variety cultivated in Madras is from 2 to 3 inches long, with a thick skin and a heavy stem. When bright-red pods are secured, after drying and grinding a good coloured powder of considerable strength is produced. The surplus crop of chillies, or that not used for domestic consumption in the fresh state, is thus dried and exported.

The shipments to all countries in the year ended March 31, 1916, amounted to 8,050,911 lb., valued at £102,100. The yearly crop in South India is estimated at about 4,000 tons. Red pepper is much used in India in curries and pickles and many other food preparations by every class of the community.

Prices of Essential Oils.

The *Perfumery and Essential Oil Record*, for August 1917, contains an article which gives an analysis and comparison of the fluctuations in price of essential oils, and allied articles from 1914 to the present year. Some of these products are largely obtained from the West Indies, and in nearly every instance the prices on the market have risen very much since the beginning of the war. This was inevitable, owing to such conditions as restriction of trade with the enemy, and shortage of freight carriers.

Taking West Indian essential oils alphabetically, it is noticeable that the price of bay oil fluctuated very much. In July 1914, it fetched in London 10s. per lb. rising to 12s. in August, and declining to 10s. 6d. by the end of the year. It then rose to 15s. in 1915, and after some minor fluctuations in 1916 settled down to 12s. 6d. during the first half of 1917.

The prices of lime oil have fluctuated also very considerably. In August 1914, distilled lime oil was being sold at 3s. 9d. per lb., while hand-pressed oil was fetching 11s. Reduced shipments caused a shortage in the market in 1915, especially of distilled oil, the price of which rose to 9s. per lb., while that of the hand-pressed article fell to 9s. 6d. Subsequently however, the price of the latter rose to a very high figure, and it remains at 16s. per lb., the distilled oil now fetching 8s.

Orange oil, which is produced to some extent in Jamaica and Dominica has shared in the rise of price, having gone up from 8s. per lb. in 1914 to 11s. at the present time.

Among allied articles, in the production of which it is hoped the West Indies will soon share, is thymol, which is obtained from the seeds of *Carum copticum* or ajowan. Experiments are being conducted on this plant in several Experiment Stations of these islands with a view to ascertaining its suitability for cultivation in the West Indies. This article has risen enormously in price, for whereas it was only 9s. per lb. in July 1914, it rose in August to 25s., and fetches 48s. at the present time.



INSECT NOTES.

THE PINK BOLL WORM.

In the last number of the *Agricultural News* the present known distribution of the pink boll worm was briefly touched upon, and reference was made to the enormous losses to the cotton industry which this pest is causing in some countries. An account was also given of the life-history of this pest, and of the habits of the moths, as observed by Mr. Busck, of the United States Bureau of Entomology, while studying this insect in the Hawaiian Islands. In the present number it is proposed first of all to refer to some of the habits of the pink boll worm itself as observed in Hawaii under artificial conditions, and then to touch upon the way this pest is spread, giving examples to demonstrate the necessity of strict quarantine measures in countries as yet uninfested by *Pectinophora gossypiella*.

LONGEVITY OF THE LARVA AND BEHAVIOUR UNDER ARTIFICIAL CONDITIONS.

As stated in the former article, the larval stage lasts from twenty to thirty days under normal summer conditions, but experiments and observations in Hawaii have shown that if the young larva is confined to dry and hard cotton seeds, either artificially, or, as may happen, in prematurely ripening bolls in the field, it will live much longer. In one experiment, heavily infested, unginced seeds were baled under strong pressure into small trial bales (24 by 12 by 18 inches) in September 1915, and placed in dry rearing boxes in Honolulu. One of these bales was examined every month afterwards, and numbers of healthy larvae were found on each examination up to March 1917. This experiment showed that the larval life of the pink boll worm may be suspended over a period of eighteen months. This ability of the larva to live within the seeds over such a long period has an important bearing on the spread of the species, since the larvae may be carried any distance in cotton seed, and may then complete their development, and produce moths capable of starting an outbreak in a new country.

In the account of the life-history given in the last issue it was mentioned that the larva of the pink boll worm, before pupating, bores a hole through the husk of the boll, thus allowing the issuing moth to escape. Experiments have shown that this instinct governs the larva under artificial conditions also. For instance, it has been observed that if an infested boll is wrapped in paper or cloth, the larva will still make a hole to the outside, and then spin its cocoon within the hole. Again, if a mature larva is confined in a pill-box or in a capsule, it will bore its way through, and then probably form its cocoon inside. Further, when green infested bolls are inclosed within a sack, the mature larvae will leave the bolls, and eat their way through the sack to pupate in more favourable places outside. It has also been found that if a larva matures within a bale of dry cotton, and happens to be sufficiently near the surface to get through the packed cotton, it will eventually cut its way through the covering of the bale, but will not normally pupate within the hole in the covering. Such a larva will seek a suitable

place outside, because of its instinct to procure a firm support for the issuing moth.

The above instances show that the pink boll worm is an exceedingly dangerous pest, for not only can the larva live for considerably more than a year in stored cotton seed, or even baled cotton carrying chance seeds, but it can also, when favourable opportunity offers, cut its way out, complete its development, and fly away as a moth to start an infestation in its new home. Like so many other insect pests the pink boll worm can never be eradicated when once it has become established, and it is therefore all the more important to impose such quarantine measures as will effectually prevent its introduction.

MANNER OF DISPERSION.

It has been observed by Mr. Busck that while the moth of the pink boll worm (*Pectinophora gossypiella*) is capable of a strong, darting flight, yet it is rather too sluggish for sustained flight, so that it does not spread to any great distance by this means, but only to adjacent fields. It is true that under favourable conditions such larvae or moths which may chance to be in loose cotton lint might be carried for a considerable distance by a strong wind, but ordinarily the wind does not play an important part in the spread of this pest. From what has been previously written about the habits of the larva, it may be guessed that man is the most important agent in the dispersion of this insect, when he imports cotton seed or baled cotton from one continent to another, and then proceeds to distribute the importations over large areas without previous inspection.

In this connexion an article in the *Scientific American* for August 4, calls attention to the fact that the area in the Laguna District of Mexico infested by the pink boll worm is much larger than was at first supposed, and that seed has been distributed from this district to other districts, thus spreading the area of infestation in Mexico. In the course of this article Mr. Houston, Secretary of Agriculture in the United States, also mentions the establishment of a cotton seed oil mill in a town on the Mexican-United States border, to which large quantities of seed infested by the worms are being moved, and states that moths have been emerging from the seed stored at this border town within a few miles of Texas cotton fields. The infestation of the Texas cotton fields by the pink boll worm would seem to be only a matter of time.

The recent establishment of this cotton pest in Brazil is referred to in a short article in *Science* for March 23, 1917. It seems that the Brazilian Government, in order to encourage the cultivation of Egyptian cotton in that country, sent an agent to Egypt who shipped large quantities of seed to Brazil. On its arrival it was distributed by a branch of the Ministry of Agriculture to inspectors in every State, who in turn distributed it free to all applicants. Dr. W. D. Hunter, the writer of this article, goes on to remark that a more thorough method of dissemination of an insect in a new country could hardly be devised. In fact, so well was the pest distributed, that in a period of less than three years it has become generally and thoroughly established in the cotton belt of Brazil. In some localities the yield of cotton was reduced by half. The eradication of the pink boll worm from Brazil has now become impossible, and it is only through the most strenuous measures in the future that the cotton industry in that country will be able to survive.

These instances show how easily a pest like the pink boll worm can become established in a new country, and only serve to emphasize still more strongly the importance of quarantine measures.

THE WORLD'S CACAO.

Under the above title the Trade Supplement of *The Times* for October 1917 has an interesting article, from which we extract the following:—

Over 40 per cent. of the world's output of cacao is grown in the British Empire, the Gold Coast being the world's largest producer. The exports from the Gold Coast in 1915 constituted about 26 per cent. of the world's production of that year, reckoning the latter at 290,000 tons. Brazil is the second largest producer of cacao, with about 16 per cent. of the total, and is followed by Ecuador (11 per cent.), San Thomé (10 per cent.), and Trinidad (a little over 8 per cent.).

Other cacao-producing countries in the British Empire are Nigeria, Grenada, Jamaica, Ceylon, St. Lucia, and Dominica.

WORLD'S PRODUCTION OF CACAO, 1915.

	Production or export.	Percentage.
BRITISH.	Tons.	
Gold Coast	77,278	26·6
Trinidad	24,145	8·3
Nigeria	9,100	3·1
Grenada	6,020	2·1
Jamaica	3,424	1·2
Ceylon	3,500	1·2
St. Lucia	924	0·3
Dominica	540	0·2
Total British	124,931	43·0
FOREIGN.		
Brazil	46,260	15·9
Ecuador	32,834	11·3
San Thomé	29,598	10·2
San Domingo	23,389	8·0
Venezuela	12,250	4·2
Fernando Po	3,710	1·3
Cameroon	2,250	0·8
Haiti	2,028	0·7
Other (estimated)	13,500	4·6
Total foreign	165,819	57·0
Grand total	290,750	100·0

Exports of cacao from the Gold Coast in 1916 were 72,062 tons, valued at £3,845,887. Cacao growing in the Gold Coast is carried on exclusively by native farmers, to whom advice and assistance are given by officials of the Department of Agriculture. The fortunes of the majority of the inhabitants of the Gold Coast are bound up with the prosperity of the cacao industry, and for this reason the difficulty of inducing the native farmer to give proper attention to the cleanliness and cultivation of his farm, the prevention of plant diseases, and the control of pests, is the cause of some anxiety to the Government and its agricultural advisers. Cacao cultivation is extending in Ashanti, and is a growing industry in Southern Nigeria, whence the exports in 1915 were 9,100 tons. Cacao has also been planted by the native,

in the Northern Sherbro district of Sierra Leone, and there are indications of the development of an important industry.

Cacao cultivation has extended of late years in Trinidad, and offers a good prospect to the small capitalist who desires to take up planting. Prices for cacao fluctuate, but there was a fair margin of profit when prices were far below the present high market quotations. The exports of cacao from Trinidad and Tobago in 1915 were 24,145 tons. Half the cacao exported from Trinidad goes to the United States. Grenada is second in importance in the British West Indies in cacao production, and the island's output in 1915 was 6,020 tons, valued at £402,394. The area planted with cacao does not extend.

Cacao is taking a leading place amongst the exports from Jamaica, and efforts are being made to encourage the industry. The area under cacao is about 11,500 acres, and the exports in 1915 were 3,424 tons, with an average value of 59s. 8d. per cwt. From St. Lucia the exports in 1915-16 were 924 tons, valued at £51,495. The output here shows a very satisfactory increase, due partly to extension of the area planted, and partly to improved methods of cultivation. Remarkable results have followed careful drainage and the application of lime. There has been a distinct falling off in the output of cacao in Dominica, the exports in 1915 being 540 tons, as against 594 tons in 1912.

THE SICILIAN LEMON INDUSTRY.

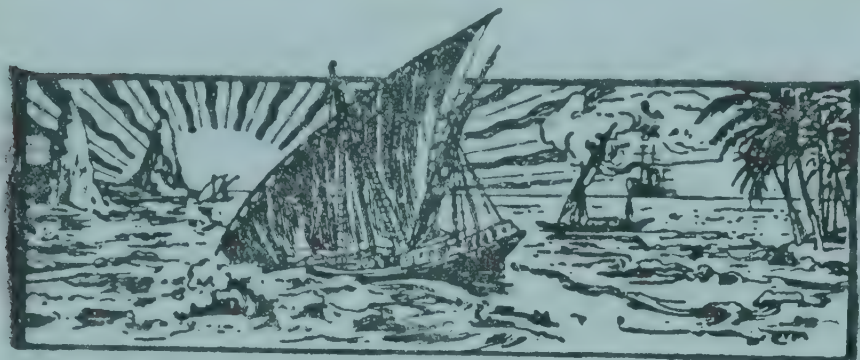
From time immemorial the cultivation of lemons has been an important industry in Sicily, but in the last twenty years it has considerably progressed. It was estimated that in 1898 there were 6,000,000 lemon trees in Sicily. From calculations based on the production and the acreage under cultivation in 1915, it is probable that there are now between 11,000,000 and 12,000,000 trees. According to statistics for June 1916, there were 88,797 acres planted in citrus trees, the larger proportion being lemons. The production of lemons alone in all Italy for 1915 was 534,300 tons. The *Journal of the Royal Society of Arts*, June 1, 1917, gives an account of the trade methods of the Sicilian lemon industry. As a rule the grower sells his lemons on the tree to a shipper or buyer for a factory. There is no organization of the proprietors, and each one sells when and where he deems best. The shippers as a rule buy a whole orchard at so much a thousand, and then gather the crop as they think opportune.

In general, when the shipper buys a crop he pays one-third of the price at the time of making the contract, one-third at the time the gathering is begun, and the remainder when the gathering is completed.

Efforts have been made at times to form a combination of the shippers in Sicily, and to establish the business on a firm basis, but these have always resulted in failure. Some of the exporters have desired to sell the fruit on order, but there are too many small shippers engaged in the business to form an effectual combination.

There is an association of fruit exporters, known as Lega Agrumaria, to which a majority of the shippers belong, but this has never changed the methods of the lemon business. It protects the shippers in various ways, however, and looks after their interest.

There is little difference in the packing for different countries, except that the English market takes a large sized case as well as one of the regular size. Also the English market prefers large sized lemons, whereas the small fruit is preferred by the American market. The Russian market requires a medium sized fruit, but of the best quality.



GLEANNINGS.

Few West Indians realize that tea is produced in the West Indies, yet, according to *The Times Trade Supplement*, September 1917, the exports of tea from Jamaica in 1915 were 20,552 lb., valued at £1,343.

The *Voice*, of St. Lucia, October 6, 1917, comments upon the difficulty local tanners are experiencing in obtaining skins for the manufacture of leather, and suggests that the Government should make enquiry into the local supply of, and demand for skins, and that exportation be only permitted in case of an excess supply.

According to the *Port-of-Spain Gazette*, October 20, 1917, froghoppers have made their presence felt in Trinidad, but measures are being taken to control the insect by means of the parasitic muscardine fungus. One planter has decided to build eighteen new fungus cabinets, and other estates are taking similar steps.

The wholesale price of cattle has been fixed in Trinidad by the Government. A Proclamation issued on October 3, 1917, enacts that the maximum prices of live cattle imported into the Colony for the purpose of being slaughtered and used for food shall not exceed 6c. per lb. (*The St. Vincent Sentry*, October 26, 1917.)

A company has recently been formed in Curaçao, Dutch West Indies, to erect a factory for the manufacture of tanning extract from divi-divi pods. These contain from 35 to 50 per cent. of tannin, but they are a bulky product for their weight, and the preparation of an extract should save a good deal in cost of freight. (*The Times Trade Supplement*, August 1917.)

According to the *Indian Rubber World* (New York) the total value of the declared exports from London to the United States in the five months, January to May 1917, amounted to \$78,779,911 against \$77,115,135 in the same period of 1916. The shipment of rubber was valued at \$31,447,629, being actually 40 per cent. of the total exports from London to the United States of America.

At a meeting of the Board of Agriculture of Trinidad, held on October 18, 1917, the Committee decided that it was desirable that seedling canes should be raised in Trinidad. In the past they had been obtained almost exclusively by the introduction of Barbados and British Guiana seedlings. As however, canes are markedly affected by soil and climatic conditions, it was probable that by raising seedlings locally, canes more suited to local conditions might be obtained. (*The Port-of-Spain Gazette*, October 20, 1917.)

Besides the shipment to the United States from Dominica of green limes, which are wrapped individually in paper, and packed in barrels with holes for ventilation, pickled limes are also exported. The process of pickling is not very complicated. Sound yellow fruit are put into vats filled with sea-water, and after a time they are removed, and packed in barrels of sea-water and shipped to Boston. Sometimes as much as \$8 a barrel is obtained for this pickled product. (*The Dominica Chronicle*, October 24, 1917.)

It will probably surprise many people to learn that China ranks third among the cotton-producing countries of the world. It is hardly a wild statement that China could be made the leading cotton-producing country. Experiments made in the vicinity of Shanghai during the last few years show that the yield per acre can easily be trebled under ordinary scientific cultivation, and there is practically no limit to the extent to which the area might be increased. (*The Journal of the Royal Society of Arts*, August 31, 1917.)

Experiments on the effect of manures on coco-nut trees are being made in the island of Nevis. From the report of the Porto Rico Experiment Station, 1915, it appears that like experiments have been in progress there since 1912. Little effect on the yield of nuts was apparent during the first two years, but, during 1915, from trees receiving a complete manure at the rate of 10 lb. per tree, a gain of 30 per cent. in the yield of nuts was obtained, and with 20 lb. per tree, a gain of nearly 60 per cent. above that from the unmanured control plot.

Nine thousand motor tractors have been ordered by the Food Production Department to carry through the scheme to add 2,000,000 acres to the arable land of the country in time for the harvest of next year. Up to the present nearly 1,000 have been received from the manufacturers, the completed total being expected to be delivered before the end of March. Of this number 6,000 have been ordered from the Ford Company, 1,000 from British manufacturers, and 2,000 from other American firms. (*The Times*, August 24, 1917.)

The *Field* for September 15, under the heading 'Tropical Vegetables' quotes largely from the annual report of the Curator of the Botanic Gardens, Dominica, regarding garden crops and vegetables in that island. In addition to widely cultivated food crops of the tropics, Dominica possesses three wild plants which yield tubers of good nutritious quality. These are (1) the Carib yam common throughout the damp districts of the island, (2) a species of *Dioscorea*, probably an escape from gardens, but now common throughout the island, which is known locally by the name of *Baba-ou-lé*; and (3) a food-plant, the 'Topee tambou' (*Calathea Allouya*).

A number of maize experiments, both for green fodder and grain produce, are conducted under the supervision of the Department of Agriculture, New South Wales. Some of these, as to the method of sowing, are of interest. Two tests in this direction were made on three stations with the Improved Yellow Dent corn: in one of these single grains were sown 15 inches apart in the field; this gave a yield on one station of 69½ bushels per acre, and on the other of 56 bushels per acre; in the other, hills of three grains were planted 2 feet 6 inches apart, giving a yield in the first case of 93¾ bushels per acre, and in the other case of 60 bushels per acre. (Report of the Department of Agriculture, New South Wales, for the year ended June 30, 1916.)

ANTIGUA ONION GROWERS' ASSOCIATION.

From the report of the work of this Association for the year 1916-17 it is evident that the Association is in a flourishing condition. This Association is an example of the benefits that accrue to any industry by co-operation on sound lines. We are glad to note that this principle is being extended by co-operation between the Onion Associations of Montserrat and Nevis with that of Antigua. The principles on which the Antigua Onion Growers' Association is being operated may be held up as an example for such associations in respect of other minor industries. From the report we take the following items of interest.

The operations of the Association during the past season have been conducted on similar lines to those of the previous one.

The onion crops of members were paid for at the rate of 1c. per lb. as soon as deliveries were made at the Association's premises; afterwards the onions were cured, graded, packed, and marketed by the Association. After working expenses were deducted, the profits, after a further deduction of 3 per cent. towards the general fund of the Association, were distributed pro rata among members according to the quantity of onions delivered by them.

During the season under report some thirty-four estates contributed their produce to the undertaking, and the total weight of onions received at the Association's premises amounted to 302,968 lb.

The total number of crates shipped by the Association was 5,664 as against 5,353 in 1915-16, the number being 311 in excess of last season's shipments; this number constitutes a record. Shipments were made to the following points: New York, Trinidad, Martinique, Demerara, Canada, Barbados, St. Lucia, Grenada, and St. Vincent.

The advertising campaign which was begun in 1915 apparently bore good results, for 734 crates were disposed of on a firm order basis, as compared with 371 in the previous season. As the total number of crates of onions shipped from Antigua for the season amounted to 6,940, it will be seen that 82 per cent. of this crop was handled by the Association.

After paying all expenses, the total sum of money available for distribution among growers amounted to £1,855 9s., or at the rate of 294c. per 100 lb. of onions delivered. In 1915-16 the bonus paid amounted to 88½c. per 100 lb. of onions delivered, and in 1914-15 the bonus was 51½c.

The continued growth of the Association is a matter for satisfaction, and the work that it has done has been the means of placing the onion industry of the island on a sound basis.

All onion growers in the island, with two exceptions, are members of the Association, and it was thought possible during the earlier part of the season that these would also become members, and in this way eliminate competition in various markets. Unfortunately these hopes were not realized.

Difficulties were experienced during the crop in connexion with the procuring of freight space to New York. The Association had at times to estimate some seven or more days before steamers left Antigua the quantity of crates that could be shipped by any one opportunity.

On the other hand, no difficulties were experienced in connexion with Canadian shipments, a reliable firm of good standing having been appointed agents in Halifax and St. John to represent the Association.

The affiliated associations in Montserrat and Nevis were kept in touch during the year with the conditions of the various markets through Antigua, and the operations of the Association have been carried on in consultation with the similar associations in these two islands.

GRASSES OF THE WEST INDIES.

The Smithsonian Institute has just published in Vol. 18, Part 7, of Contributions from the United States National Herbarium, a monograph on the above subject by A. S. Hitchcock and Agnes Chase, Agrostologists attached to the United States Department of Agriculture.

The paper in question brings together in a convenient form the knowledge of the grass flora of the West Indian islands up to date. The flora of particular islands, and in fact of the region as a whole, has been studied by many botanists, but no special account of the grasses found in the islands has hitherto been published. The present monograph is based upon large collections from practically all the islands of the group, and upon field studies by both authors in many individual islands.

The grasses of the West Indies are here grouped under 110 genera, and 455 species, of which one genus and seventeen species are new to science. Brief descriptions are given of the salient characteristics of the species and genera, and notes of the habitat of each species. Appended to the paper there is also a list of all the numbered specimens of West Indian grasses in the United States National Herbarium. A short introduction to this very useful addition to the knowledge of West Indian flora gives a brief bibliography of the works of botanic authors who have hitherto touched on or dealt with the subject.

CASHEW NUTS.

The cashew nut (*Anacardium occidentale*) was originally found in South America and the West Indies.

From the *Journal of the Royal Society of Arts*, April 27, 1917, we learn that this tree, so well known in the West Indies, is becoming the source of quite a considerable industry in Southern India. Until twelve or fifteen years ago the nuts were merely gathered for local consumption. The advent, however, of European interests into the business, has given an impetus to the trade in cashew nuts; so, to meet the demand, the tree is being regularly cultivated.

The journal referred to above says that the fruit is only eaten by the lowest classes in India. In the West Indies it is well known that the juice of the fruit, when thoroughly mature, although slightly astringent, is very refreshing and palatable. It is true that there is a large amount of fibrous matter in the so-called fruit, which is really only a modified swollen peduncle, but the juice extracted, whether by the teeth or by wringing the fruit in a cloth, affords a pleasant fruit beverage.

The commercial value of the plant is, however, in the nuts, which are the real fruit, depending from the fleshy, juicy, peduncle. From this they are detached, and after being roasted, the kernels are removed from the shells, and sent to market for sale. Some improvement in the method of preparation is desirable, because much of the product is spoiled through insufficient drying.

From Southern India something like 15,000 cwt. of these nuts are now exported annually to England, France, and America. They are used for the same purposes as almonds, and West Indians will not consider them inferior to those ancient nuts for culinary purposes.

It may be worth while noting that the oil contained in the outer covering of the nuts has distinct irritant and corrosive properties. The writer of this note does not know that this oil has ever been put to any use, except that it is considered of value by the West Indian labourer as an agent in removing warts.

BIOLOGICAL STUDIES APPLIED TO AGRICULTURE

In a most interesting and charming account of a visit paid to the United States in 1913, M. Paul Marchal, Director of the Entomological Department of the French Ministry of Agriculture, brings vividly before his readers in Volume III of *Annales du Service des Epiphyties*, published in Paris in 1916, the wonderful organization of the United States Department of Agriculture in biological studies applied to agriculture. To this account we are indebted for the following remarks which have been freely translated from the French original, and which are likely to be of interest to the readers of this Journal.

The intensity of the struggle against the various enemies of cultivated plants, which goes on in every agricultural country, is especially noticeable in the United States. This is explicable because of the extreme severity of the attacks of parasitic plant pests in that country, where uniformity of crops over immense areas furnish such pests with the richest and most abundant food supply.

There are three distinct methods employed in the struggle against the various parasites which ravage the crops: (1) cultural methods, the aim of which is to endow the plants cultivated with more vigour and power of resistance; (2) biological methods, which aim at the control and destruction of the pests by means of natural enemies, insects or fungi, themselves parasitic on the noxious insect plant pests; and (3) technical methods, which aim at the destruction or control of the pests by chemical, physical, or mechanical appliances.

Interesting as is M. Marchal's description of the first and third of these methods, it is not intended in this article to refer to them. The story of how American genius and application have employed the biological method is one of the fairy tales of science of modern times. The struggle on these lines may be strictly divided into two methods: (1) the introduction and acclimatization of insects predatory upon the noxious plant-eating species; and (2) the introduction and dissemination of fungi which are poisonous to and destructive of, the insect plant pests. The first method in the hands of the American scientists has proved brilliantly successful in several instances. One need only mention the successful introduction of a small Australian beetle (*Novius cardinalis*) which preys upon a scale insect of orange trees (*Icerya Purchasi*). This scale insect seemed at one time to threaten the extinction of the large Californian orange industry, but in a short time after its introduction, this predatory beetle had almost annihilated the pest.

Whenever one is confronted by the appearance of exotic insect pests which do more damage in their new home than in their original habitat, there is reason to think that these pests have been introduced without the parasites or natural enemies which limit their increase in the country from which they come. It is remarkable that there are found in America many more noxious insects of exotic, and particularly of European, origin, than are found in Europe of American origin. This is doubtless explained by the fact that there has been a much larger introduction of various plants into America from Europe than vice versa. It is therefore not astonishing that the method of combating the insect foes of the agriculturist by means of parasites has had its greatest development in America.

Predatory or parasitic insects are not the only natural agents which it has been sought to employ in the struggle against harmful insects. Great hopes in fact have been founded on the artificial dissemination of diseases caused by fungi which live on insects, and by microbes. In America

numerous researches have been made particularly with respect to fungi which live on insects. Certain fungi play a great part in restraining the increase of scale insects, as for instance, *Sphaerostilbe coccophila*, which exercises in Florida such an efficacious control over the purple scale (*Mytilaspis Beckii*) that orange planters only employ fungicide sprays in extreme cases, because they know that their use only tends to destroy the *Sphaerostilbe* at the very time that the scales begin to increase, which consideration restrains the planters from treating their orchards with chemical insecticides. These facts are well known also in West Indian citrus orchards where *Sphaerostilbe* is abundant.

In Florida also it is well recognized what an important part is played by parasitic fungi of the genera *Aschersonia* and *Aegerita* in limiting the spread of *Aleurodes citri*, one of the most troublesome pests of citrus plantations. Those who have studied the question agree that, thanks to the presence of these fungi, orange and lemon orchards are frequently practically cleared of the scales referred to.

Unfortunately, it is impossible at present to lay down the rules of procedure which would with certainty develop epizootic maladies among insects, and so obtain by means of the distribution of parasitic fungi sufficiently constant results to cause the employment of this method to be resorted to as a regular practice. The development of these fungi in many cases appears to depend too much, more or less, on exterior conditions, such as moisture and temperature, over which there is no means of control.

It seems to be proved from the experiments in Florida that it is quite possible to create new centres from which the distribution of such parasitic fungi as *Aschersonia* and *Aegerita* may take place. The question, however, as to whether these fungi can be increased in orchards where they already exist seems to be far from being positively settled. A long series of experiments made by competent mycologists as to whether it was possible to augment in any profitable way by artificial means the numbers of these beneficent fungi in orchards where they are already to be found, has given only negative results; and the present position is, that in a locality where these parasitic fungi already exist naturally, it is not profitable to spend labour and time in endeavouring to multiply them artificially. This view has been held for some time by the mycologists of the Imperial Department of Agriculture.

As regards flying insects, such as locusts and grasshoppers, recent researches in America in the employment of parasitic fungi as a method of control yield no more positive results than with regard to scale insects. If weather conditions are favourable, the spores already existing in the locality affected will cause the fungus to exercise its maximum effect. If, on the contrary, external conditions are unfavourable, the spores artificially disseminated will germinate no more numerous than those present naturally, and no added increase will result.

With regard to burrowing insects, the question is just as much undetermined. New experiments are required in the direction of ascertaining whether it will be possible to combat them by means of parasitic fungi. Experiments being conducted on species of *Lachnosterna* in Illinois seem to hold out some hope that the method will prove of practical value in such cases.

The same conclusions seem to hold good as to the control of insect pests by diseases caused by malignant bacteria, and kindred organisms. It would seem that insect mortality caused by such organisms only becomes serious and epidemic when external conditions become unfavourable to the life of the insect, so that experiments in artificial dissemination of

such bacteria in order to control insect attacks have led to no conclusive results.

From the foregoing remarks it must by no means be concluded that the artificial employment of these microbic diseases ought to be given up. Observations of microbiologists tend to show that in certain localities an infectious disease of this nature among insects is capable of completely disappearing, and that in such a case attempts to reintroduce it by means of artificial dissemination would be perfectly justifiable. Perhaps also it may be possible to increase artificially the virulence of the disease, whenever its destructive action appears to be weakening.

It will be seen from the foregoing that if the study of the microbic diseases affecting insects has not yet afforded the key of a method of direct combat against the insects which devastate crops, it no less presents an aspect of importance, which accounts for the energy with which it is pursued in the United States. The steps already made in this direction are capable of revolutionizing previous conceptions of the factors which regulate plant-eating insects as to the degree of damage which they cause either in their original habitats, or in countries into which they have been recently introduced. These investigations are also of such a kind as to react profoundly on the organization of the struggle against the insect enemies of agriculture.

In view of the experiments being made with the Muscardine fungus as a control of froghopper in Trinidad, and of cacao thrips by *Sporotrichum globuliferum* in Grenada, the above considerations may conduce to a hopeful patience.

RECIPES FOR COOKING HORSE BEANS.

The value of the horse beans (*Canavalia ensiformis* and *C. gladiata*) as food for human consumption has been several times pointed out in the pages of this Journal, see for instance, Vol. XV, p. 158. Two recipes for preparing them for the table, given in the *Journal of the Jamaica Agricultural Society* for September 1917, will probably be found useful.

The first is for cooking the young pods as French beans. The pods should be picked when they are not more than about 6 inches long. To avoid their turning an ugly colour in boiling, they should be sliced thin into a bowl of cold water, and whenever the knife used shows any stain it should be wiped clean on a damp cloth. Throw off the water in which the pods have been sliced, put them into fresh cold water, and let them stand there for about ten minutes. Then put them on in still another lot of water, with a pinch of soda added, to boil. They ought not to be boiled longer than about three minutes.

The second recipe is for cooking the dry beans, the only drawback to which is their tough skin. Put the beans into cold water with about half a teaspoonful of soda added. As soon as they begin to boil take out the beans with a spoon, and drop them into cold water immediately. The skins can then easily be pulped off. Put the beans back into the water with the soda, and boil until cooked, which takes however a long time.

Doubt still appears to linger in Jamaica concerning the wholesomeness of these beans; it may be stated, however, that they are being freely eaten in other islands.

An analysis of this bean made by Mr. H. S. Shrewsbury, Acting Government Analyst of Trinidad, showing its nutritive value, and freedom from toxic substances, appeared in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Part 2.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of September 1917:—

The amount of business transacted in the produce market during the month of September is always, even under normal conditions, more or less limited, from the fact of its being the holiday season of the year, and though the two past years have been exceptional with regard to holiday keeping, the case has been different this year; the holiday temperament has been unusually high—a kind of reaction after months and years of unusual depression. But it does not follow from this that the markets have revived correspondingly; indeed buyers continue to be satisfied with purchases sufficient only to meet present needs. The following are the chief items of interest.

GINGER.

At auction on September 13 a good supply of ginger was brought forward, amounting to 893 packages, but nearly the whole was bought in at 75s. per cwt. for washed rough Cochin, and 70s. for brown rough Calicut. 100 bags of Sierra Leone were held at 57s. per cwt. It was stated that some small sales of this latter had been made at Liverpool at 49s. A fortnight later, namely on the 27th, at the London auction the offerings were as follows: 257 bags of rough washed Cochin, all of which were held at 68s. to 70s. per cwt.; of brown rough Calicut 172 packages were held at 65s., and some 130 bags of wormy Sierra Leone at 52s. 6d. to 57s. 6d. Some 60 bags of limed Japanese were also held at 47s. 6d.

SARSAPARILLA.

At auction on the 20th of the month sarsaparilla was in fairly good supply, being represented by 19 bales of grey Jamaica, 10 of Honduras, 6 of native Jamaica, and 30 of Mexican. Twelve bales only of the grey Jamaica were disposed of at 3s. 9d. per lb. for fair rolled. None of the Honduras was sold, being held at 3s. per lb. Of the Mexican, 19 bales were sold, 1s. 8d. being paid for sound, and 1s. 4d. for slightly damaged.

CITRIC ACID, CASIA FISTULA, LIME JUICE, LIME OIL, PIMENTO, TAMARINDS.

At the beginning of the month citric acid was in very slow demand, at previous rates; as the month advanced, however, it dropped to 3s. 2d. per lb., but at the end of the month it again rose to 3s. 3d. At the beginning of the month Cassia Fistula pods were stated to be in small demand, with a limited supply at 60s. per cwt. for lean pods from Bombay. A week later the quotation was 70s. per cwt. At the beginning of the month good lime juice was realizing 3s. per gallon, at which price it was said the market was nearly cleared. Lime oil was said to be fairly plentiful throughout the month, West Indian distilled realizing 7s. 6d. per lb., and hand-pressed 14s. At the beginning of the month pimento was quoted at 3½d. per lb., but before the end of the month 4d. was being asked. The large consignment of 137 packages of tamarinds from Madras was offered on the 20th of the month but failed to find a purchaser.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
September 20, 1917.

ARROWROOT—5½d. to 6¾d.
BALATA—Block, 3/2; Sheet, 3/9 to 3/11½.
BEESWAX—No quotations.
CACAO—Trinidad, no quotations; Grenada, 86/6 to 87/-;
Jamaica, 80/- to 86/-.
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—Bananas, no quotations; Oranges, no quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, 80/- to 90/- per cwt.
LIME JUICE—Raw, 2/- to 3/-; concentrated, £30; Otto of
lime (hand-pressed), 16/- per lb.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—3¾d. to 4d. per lb.
RUBBER—Para, fine hard, 3/2½; fine soft, no quotations;
Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., October 18,
1917.

CACAO—Venezuelan, \$13.50; Trinidad, \$12.75 to \$13.25.
COCO-NUT OIL—No quotations.
COFFEE—Venezuelan, 12c. to 14c. per lb.
COPRA—7½c. per lb.
DHAL—No quotations.
ONIONS—\$8.00 per 100 lb.
PEAS, SPLIT—\$12.00 to \$12.50 per bag.
POTATOES—English, \$4.50 to \$5.00 per 100 lb.
RICE—Yellow, \$10.50 to \$11.75; White, \$9.25 to 9.50
per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., October
31, 1917.

CACAO—Caracas, 12¾c. to 13c.; Grenada, 12¼c. to 12½c.
Trinidad, 12½c. to 13c.; Jamaica, 9½c. to 10½c.
COCO-NUTS—Jamaica and Trinidad selects, \$58.00 to
\$60.00; culls, \$38.00 to \$40.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—16c. to 20c. per lb.
GOAT SKINS—Jamaica, 75c.; Antigua and Barbados, 65c. to
70c.; St. Thomas and St. Kitts, 60c. to 75c. per lb.
GRAPE FRUIT—Jamaica, \$2.75 to \$3.50 per box.
LIMES—\$4.50 per brl.
MACE—38c. to 42c. per lb.
NUTMEGS—18c. to 19c.
ORANGES—\$2.75 to \$4.00.
PIMENTO—6c. to 6½c. per lb.
SUGAR—Centrifugals, 96°, 6.90c; Muscovados, 89°, 6.64c.
Molasses, 89°, 5.75c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., October
30, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MOLASSES—No quotations.
ONIONS—\$12.00.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$6.75.
RICE—Ballam, \$10.00 to \$10.80 per 180 lb.; Patna, no
quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, no quotations.

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Stimulation of Interest in Education.

IN the last issue of this Journal attention was drawn to the stimulus that is likely to be given to educational questions by the appointment in St. Lucia of a Commission to enquire into and report upon these matters on broad lines; attention was directed to the agricultural aspect of the matter, particularly with respect to primary teaching. The aspect as regards secondary teaching may now be considered.

In the first place it may be suggested that the higher form of education is, if anything, of even greater importance than the lower, for the higher form touches immediately those youths who, on reaching maturity,

are likely to have much influence on the general direction of affairs, whether in matters relating to the government of the colony, the conduct of commercial business, or the oversight and direction of agricultural matters: it is obvious that it is essential that those who are, in their several degrees, to guide affairs must be trained to think soundly, or there can be little progress or development.

It is open to question whether, particularly in the smaller colonies of the West Indies, secondary education has had as much care on the part of the State as it really warrants. It would seem that the Departments of Education have been concerned more with primary than with secondary education, the latter being left more to private enterprise and personal direction, with comparatively little government supervision, though it has received a measure of government assistance.

While it is generally admitted that it is most desirable, and even vitally necessary, to include the teaching of science in the curriculum of the secondary schools of the West Indies, and that the science taught shall have largely a bearing on agriculture, it must be admitted that what has been effected in this direction falls short of what is to be desired.

It will be useful to remind our readers that this aspect of the case was prominently to the fore when the Imperial Department of Agriculture was established, and liberal monetary grants were made by the Mother Country for the assistance of these colonies. What was done in this connexion is summarized in the *West Indian Bulletin*, Vol. XI, p. 440. From this it will be seen that for nine years payment was made from Imperial funds

for a Lecturer in Agricultural Science at Harrison College, Barbados, and, for seven years, five local Agricultural Scholarships to this College, each of an annual value of £50, were maintained from the same source, while two of an annual value each of £75 were given for scholars from the Windward Islands, and one from the Leeward Islands. For several years the cost of the Agricultural and Science Masters at the Grammar Schools at Antigua and St. Kitts were defrayed from Imperial funds, as were some eight local scholarships at each of these schools.

For some six or seven years assistance was also given to Jamaica from Imperial funds in this matter of providing science teaching in secondary schools.

With the reduction of the Imperial Grant the duty of maintaining this work fell upon the local Governments, by some of which, as at Barbados, the work has been well maintained; in some instances its maintenance has not been pressed with that vigour which seems desirable. It is hoped that the present stimulation of thought in this direction may bear fruit.

It must be admitted that in small communities, with their necessarily small schools of a grammar school standard, it is very difficult to maintain the diversified forms of teaching which modern ideas demand. It is recognized that attention must be given to classics, mathematics, English subjects, and science, while according to modern ideas, 'games' play an important part in the formation of character, and the maintenance of the tone of a school. Adequately to teach these subjects demands a highly diversified staff, such as is not really obtainable in a small school. From the nature of things, particularly from the class from which our teachers and masters have been drawn, there has been a natural tendency, first for classics and English subjects to have consideration, then mathematics, while science, until quite recently, has fared badly, mainly because of the difficulty of obtaining qualified teachers, a difficulty which is increased when it is required that the science teaching shall largely have an agricultural bent.

In this way it came about that science teaching has been to a certain extent dependent on the Agricultural Departments. These departments have men possessing the requisite knowledge, though not always trained as teachers, and there have been frequent demands for their services in connexion with the grammar schools and colleges. In a measure this is sound and useful, but it has many dangers and pitfalls. First, perhaps, is the underestimate in the

popular mind of the time and effort required for teaching; it is thought that two or three hours a week may be given to teaching, without serious interruption to other duties. It is forgotten that good teaching requires thought and preparation, and that the interruption coming at regular, fixed periods, may be serious as regards the other duties of the officer engaged to teach. As a consequence, unless very carefully supervised, there is great danger of these dual duties proving inefficient in both aspects, and disappointment and failure resulting.

As regards the teaching to be given in a West Indian secondary school, it will probably be generally admitted that this, in the case of the average boy who is to follow an agricultural or commercial career, should include a general knowledge of elementary science of such a character as to enable him to take an intelligent interest in his daily surroundings; he should have at least an elementary knowledge of the main facts of plant and animal life, and at least some rudimentary training in chemistry and physics. The examinations of the principal examining bodies recognize this, and make provision for testing the acquirements of the scholars in these particulars. With careful selection of subjects on the part of the teachers, a scholar may acquire the necessary useful training, and the examination system, in spite of its disadvantages, may here serve as a help and guide alike to teachers and pupils. It is to be remembered that examining bodies are willing to modify their requirements so as to serve to good advantage the needs of the several districts with which they are concerned. The main point to insist on is, that for the average boy there must be a reasonable amount of general science taught, not as technical training, but as general education.

Science teaching requires special equipment in the way of apparatus and laboratories, while, in its agricultural aspects, it necessitates some access to land. All this imposes difficulties such as are not experienced in the teaching of many school subjects; for this reason there is a tendency to shirk the teaching of science, and particularly of agricultural science in ordinary schools. To overcome these requires money and men, and only moderate success can be hoped for from makeshift methods, and it is well to face the problem boldly. Here it is that State aid and State encouragement, which are not necessarily synonymous, will be of great value, particularly in the smaller communities.

It frequently happens that a desire to extend the teaching of agricultural science in a school leads those who are anxious to push the movement to make

demands for teaching and training which are really technical in character. Briefly stated, the advocates of the movement desire that the boys shall be taught to be planters, and they express disappointment when, on leaving school, the boys manifest unfamiliarity with routine matters connected with the chief industries of the place. A little reflection will show that this is unreasonable. In the first place the chief requirement of the school period is the imparting to the scholar of the rudiments of a general education; his general outlook must be considered; many subjects have to be taught in order that he may have a well balanced mind, and in order that his faculties may be so trained that he may be able to assimilate information, and develop in after life. Science cannot be taught without a knowledge of general subjects, of mathematics, and of a general ability to think and reason. There can thus be little time for specialization in science until a boy has been long at school, and the majority of boys leave school before that time is reached. The function of the school, therefore, is general education. Technical training is an affair that must have consideration later; it is the function of the University, the Technical College, or of the daily routine course of business. It is in this latter school that so many of our local youths have to gain their experience, and to gain it with much labour, very imperfectly, so that there is the earnest desire for the technical training which the school cannot fulfil.

Much will be gained if on leaving school our boys, and for that matter, our girls too, have been so educated that they are able to regard with lively interest and intelligence the facts of everyday life—how plants and animals live and grow, what are the objects of the daily work of the planter, and the gardener, and the merchant,—and of the daily routine of the home, and thus to have educated and receptive minds, capable of acquiring the technical skill which their particular function in this workaday world demands.

A good deal has been done in the direction of technical training in various grades with the assistance of the Departments of Agriculture: reference will be made to this in another article.

Colonial Reports—Annual, No. 926, shows that in Fiji the usual agricultural interests of tropical countries are being developed. As regards the sugar cane industry for instance, 120,528 tons of sugar were exported in 1916, together with 13,346 tons of molasses. The molasses exported is carried in special tanks in bulk by the steamers of the Colonial Sugar Refining Company to Sydney, where it is manufactured into industrial alcohol. The average quantity so manufactured annually is estimated to be 1,000,000 gallons.

SUGAR INDUSTRY.

THE SEARBY SYSTEM OF MILLING SUGAR-CANE.

A method of preparing sugar-cane for the mills, invented by Mr. William Searby, of Hawaii, is receiving a good deal of attention in sugar circles. This method consists in shredding the cane to a fibre condition which observers have characterized as resembling the well-known excelsior packing material. This is effected by means of a shredding or beating machine consisting of a series of pivoted hammers which rotate in a casing containing anvil bars suitably spaced, and parallel to the axis of rotation of the hammers. The principle on which this machine works is somewhat similar to that of the well-known 'disintegrators', of which there are several in operation in various parts of the West Indies for grinding cotton seed, grain and other materials.

It is claimed for the Searby Shredder that it secures a more even feed for the mills, and that it naturally lessens the power required to drive them. This reduction is stated to be practically equivalent to the power required to drive the shredder itself.

It is also claimed that it enables a better extraction of sugar to be obtained by the mills, and that the maceration water can be used to better advantage.

The capacity of the mills is also stated to be very considerably increased.

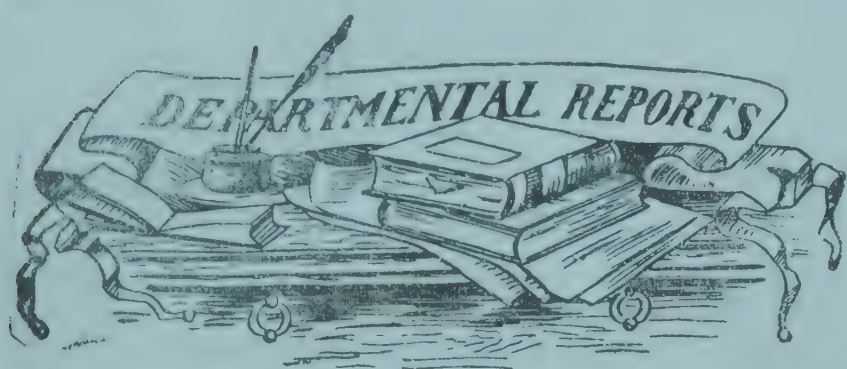
The work of these shredders has been critically examined in Hawaii, where probably the milling of the sugar-cane has reached the highest degree of efficiency, and careful observers have expressed the opinion that the use of these shredders may be expected to increase the efficiency of the best mills by about 1 per cent., and the increase may be expected to be larger in the case of less efficient mills. The mills of high standard in Hawaii, operating without the Searby Shredder, are capable of extracting some 94 to 95 per cent. of the sucrose in the cane; with the shredder, an extraction of 95 to 96 per cent. is looked for; while in 1916 recoveries of 97.73, 97.68, and 97.49 are reported from Hawaiian factories.

This striving in other countries for complete extraction of sugar from the cane is of significance to West Indian sugar producers. In a few instances in the British West Indies there are efficient mills extracting some 95 per cent. of the sucrose in the cane, but they are very few in number: the majority even in large factories, probably extract less than 90 per cent.

It is important that factory owners should know accurately what their mills are doing, and what measure of improvement is possible in their case. The efforts of their competitors in other countries are significant of the intensity of the competition that is likely to ensue when normal conditions of sugar production are restored.

Sugar Purchase Announcement.—The following announcement, dated November 7, 1917, has been issued by the International Sugar Committee in New York, and signed by Henry C. Mott, Agent for Arranging Purchases of Raw Sugar:—

'It is the intention of the International Sugar Committee to respect and not to disturb the channels through which purchases of sugar have hitherto been made either for the United States or for the European Allies, and to continue the intermediary of brokers and of agencies as heretofore.'



ST. KITTS-NEVIS: REPORT ON THE AGRICULTURAL DEPARTMENT, 1916-17.

This report, which has just been issued, shows a continuation of useful work on several lines, together with some new experiments which are of interest and value.

In the first place, we notice that the wind-break at the Botanic Station of white cedar trees (*Tecoma leucoxydon*) is being replaced by one of *Casuarina equisetifolia*. This will be a great improvement, as the white cedar, although a native tree, does not present a handsome appearance when grown in a very wind-swept situation, while the Australian *Casuarina* only seems to bend more gracefully the more it is blown on; besides, it stands cutting well, which serves to keep it dense at the base.

The small plot experiments with a variety of locally grown food crops, which have been in progress for a series of years, are being continued. The results obtained and recorded over a considerable period are valuable as furnishing reliable data as to the relative value of different varieties. From the produce of these experimental plots also it is possible to distribute seeds or cuttings of such varieties as have proved best adapted to local conditions. An addition has been made in the year under review to these plots, by an experiment with ajowan (*Carum copticum*), from which thymol is extracted.

Turning to the principal agricultural industries of St. Kitts-Nevis, we note that the manurial experiments with cotton are being continued. These experiments have been in progress since 1904. The carefully recorded results for such a number of years are very instructive. For the first eleven years the results seemed to show that there was little if any increase of lint produced on manured plots over that produced on the no-manure control plot. For the last two years, however, the results show that the manures regularly applied year after year are producing a markedly beneficial result. On the crop of the year reported on, 1916-17, the plot treated for thirteen years with a complete artificial manure showed a gain of about 26 per cent. over the unmanured control, while the plot to which pen manure had been applied for a similar period showed a gain of nearly 50 per cent. over the control. Although these results show that the application of proper fertilizers to cotton must be beneficial in the long run, yet they seem to prove that under certain conditions of soil and climate, such as are found in St. Kitts, it is possible to grow cotton on the same land for some years without deterioration or diminution in the crop. It must be borne in mind, however, that under the conditions of other islands this may not hold good, as Harland has shown in St. Vincent the necessity of employing potash. (See *West Indian Bulletin*, Vol. XVI, p. 159.)

The careful selection of cotton seed for planting purposes has been productive of excellent results. A pure strain possessing desirable characteristics has thus been obtained, and is being generally planted from selected seed throughout the Presidency as giving reliable returns. On this result the Department is to be warmly congratulated.

Owing to the unfavourable outlook with regard to the cotton market at the beginning of 1916, and to the rise in the price of sugar, there was a great reduction in the acreage devoted to cotton. The year under review was also one of abnormal rainfall. Owing to both these causes the exports of cotton from the three islands of the Presidency, St. Kitts, Nevis, and Anguilla, only amounted to 280,652 lb. as against 736,471 for the previous year. Better market conditions and more seasonable weather will doubtless exercise a stimulating influence on the industry.

With regard to the sugar industry it is to be noted that the exports of sugar from the Presidency for the year 1916 were 16,106 tons, the largest amount recorded since 1902. As the prices were also high the crop was a very paying one. The increase in output was due to favourable weather conditions, and to the larger recovery of sugar from the cane owing to the first-rate work of the Basseterre sugar factory.

Experiments with sugar-cane varieties, and manurial experiments continue to be conducted as in former years, the results of which are detailed in a report issued for the Leewards Islands as a whole.

It is very interesting to note that a number of cane seedlings have been grown by Mr. G. Yearwood, of Brighton estate. Sixty of these have proved worth further experiment as to their value under field conditions. The progress of this experiment will be watched with interest. It would be well if more planters would interest themselves in what is after all an easy matter, the raising of sugar-cane seedlings, and obtain the readily accessible assistance of the Agricultural Departments in ascertaining their value.

The rainfall in St. Kitts at the Botanic Station for the year 1916 was 65.94 inches, being 18.34 inches above the average of the previous fifteen years.

The work of the Department in Nevis on experimental plots of ground provisions and other food crops continues, with the same praiseworthy objects as in St. Kitts. One new experiment appears to be in process, namely with the castor oil plant. This is being carried out at the request and at the expense of a local planter. Such attempts to test new crops with the co-operation of the Department are bound to be helpful.

A very instructive series of experiments has been conducted for the past two years, also with the co-operation of the Department's officers, on Pinneys estate in manuring coco-nuts. These experiments with different manures have not been continued long enough to enable a positive statement to be made as to what manure is best suited for the purpose. The results, however, up to the present, all show a large increase in the average number of coco-nuts borne by the trees which have been manured over the number borne by trees which have received no manure. These experiments have been referred to in detail in the *Agricultural News*, Vol. XIV, No. 335, p. 398, and Vol. XVI, No. 389, p. 83.

It is pleasant to note that the Nevis onion growers have united in a co-operative association on the lines of that so successfully working in Antigua, and in connexion with it. This is excellent; for co-operation is the secret of success in any industry, and the wider the co-operation, the broader and surer will be the basis on which an industry is placed.

The rainfall in Nevis as in St. Kitts for 1916 was considerably above the average for the past eleven years, being 64.04 inches as compared with the average of 49.49 inches.

Attached to the St. Kitts report is a report of the work done in the Government Laboratory. A specially useful piece of work is likely to be that on the lime requirements of the soils of the island.

BARBADOS: REPORT ON SUGAR-CANE EXPERIMENTS FOR THE SEASON 1915-17.

The report on experimental work with sugar-cane in Barbados for the season 1915-17 has recently been published. As in former years, the report is divided into three sections: Part I relating to rainfall, Part II dealing with manurial experiments, and Part III with the work of raising new varieties.

With regard to Part II, it is stated that the results obtained were so seriously interfered with during the season under review as in previous years, by the root borer and the brown hard back, as to mask the true results of the manuring, and to render it impossible to draw any definite conclusions from them.

Turning to Part III, further progress is recorded in regard to the establishment of seedling canes giving increased returns per acre. The weather, on the whole, was favourable, and a large number of new seedlings were raised, but much trouble was occasioned and considerable damage inflicted by the pests already referred to. The following are the principal results obtained with the different seedlings cultivated by the department during the season under review:—

In the black soil districts, the average yield of the White Transparent from nineteen plots was equivalent to 5,408 lb. of muscovado sugar per acre. Of the varieties, B.H. 10 (12) which came first, gave a yield of 8,713 lb. of muscovado sugar per acre—an increase of 3,305 lb. over the White Transparent. W. No. 2 came next, with 8,352 lb. of muscovado sugar. B.6,835 came third, with a yield of 8,171 lb. of muscovado sugar. B.12,619 came next, with a yield of 7,727 lb. per acre.

On the red soils, as is seen from Table VIII, the average yield of the White Transparent as plant canes was 4,090 lb. of muscovado sugar per acre, while some of the better seedlings gave much higher yields. For instance, the B.H. 10 (12) gave a yield of 9,276 lb. of muscovado sugar per acre, Ba. 12,079 came next with 8,956 lb. With Ba. 6032 the yield was 7,937 lb. B. 6450 gave a yield of 7,327 lb. Five other varieties also gave increased yields over the White Transparent.

On the red soils as plants, first, and second ratoons, grown during the season under review, the White Transparent gave the equivalent to 12,480 lb. of muscovado sugar for the three crops. Ba. 6032 gave 18,338 lb. of muscovado sugar. B. 6450 came next with a yield of 17,078 lb. of muscovado sugar. B. 3922 gave 17,009 lb.; these also being calculated on the basis of the three crops.

Referring to Table X, which gives the average results of some of the better varieties for the past five years, it will be observed that on the black soils the White Transparent, which came out thirty-first amongst all the varieties cultivated in the black soils, gave an average yield of 4,999 lb. of muscovado sugar per acre for the five years 1913-17. B.H. 13 (12), which heads the list, gave an average yield of 9,276 lb. of muscovado sugar per acre. Ba. 6032 came next with 7,819 lb., Ba. 8846 gave a yield of 7,582 lb., while W. No. 2, Ba. 8421, Ba. 12619, and Ba. 7924 gave yields of 9,027 lb., 9,005 lb., 8,927 lb., and 8,901 lb., respectively, of muscovado sugar per acre.

In the red soils, the White Transparent as plant canes for the five years gave an average of 5,106 lb. of muscovado sugar per acre. Ba. 6032 which heads the list gave a yield of 7,544 lb. of muscovado sugar per acre. B. 6450 came next with a yield of 7,428 lb. Three other varieties, Ba. 2471, B. 3922, and B. 376 gave yields, respectively, of 6,698 lb., 6,175 lb., and 5,517 lb. of muscovado sugar per acre.

During the last season three varieties, namely B.H. 10(12), Ba. 6032, and Ba. 7924 were considered worthy of being tried under ordinary plantation conditions. There are also four new varieties, seedlings of the B. 6450, which have been cultivated for the past two years in comparison with the White Transparent and B. 6450, and which appear to be worthy of extended cultivation. Cuttings of these four varieties were planted in the selected seedling sugar-cane experiment plots. These varieties are—B.S.F.12 (45), B.S.F.12 (34), B.S.F.12 (27), and B.S.F.12 (24). The results of these seven varieties are given in Tables XII-XV. As will be seen from these, B.H.10 (12) has given in the same fields, on the average for four years, from twenty-one plots, 2,478 lb. of saccharose per acre more than the B.6450, and 4,239 lb. more than the White Transparent. Ba. 6032 has given in the same fields, on the average for four seasons, for forty-nine plots, 1,303 lb. of saccharose per acre more than the B. 6450, and 3,222 lb. more than the White Transparent. Ba. 7924 has given, on the average for four years, from sixteen plots, 1,057 lb. of saccharose more than the B. 6450, and 2,788 lb. more than the White Transparent. Of the four new varieties, B.S.F.12(45), on the average from two plots during the last two seasons, has given 1,892 lb. of saccharose per acre more than the B.6450, and 2,875 lb. more than the White Transparent; B.S.F.12(34), B.S.F.12(27), and B.S.F.12(24) gave, respectively, 2,416 lb., 3,506 lb., and 4,500 lb. of saccharose more than the B.6450, and 3,399 lb., 4,489 lb., and 5,483 lb. of saccharose per acre more than the White Transparent.

PROGRESS IN TROPICAL AGRICULTURE.

At a General Meeting of the Anglo-Dutch Plantations of Java Co., Ltd., held in London, September 12, 1917, the Chairman, the Hon. Charles Hedley Strutt, in the course of his speech made some remarks which ought to be kept in mind by everyone interested in the development of tropical agriculture. He said: 'I have made it a custom every year to deal fairly fully with our different products, but I shall say little this year, as there are not many new developments. It is, however, worth while to call your attention to one feature of our tropical agriculture—that is, the rapid improvement that is taking place in the methods and organization in all those cultures that have comparatively recently come under European control. Whereas in English agriculture, with which I am well acquainted, a good farmer thirty years ago would be a fairly good farmer still without any change of methods, it is by no means certain in tropical agriculture that an up-to-date manager of five years ago would not, unless he altered his methods, be most hopelessly behindhand at the present time. Old industries change slowly, new industries very fast. This is of vital importance to bear in mind. It behoves every manager never to rest satisfied with the methods that were thought satisfactory a few years ago, and it behoves still more that visiting agents should every few years be allowed to visit other countries and districts from time to time to see what improvements in methods and systems have been carried out elsewhere.'

These remarks from the Chairman of a large company, who is himself an agriculturist of wide experience and reputation, bear out the position which has been consistently taken up by the Imperial Department of Agriculture, namely, that it is of the utmost importance, if the various products of the West Indies are to continue to be grown profitably, that all those engaged in the cultivation of them should be wide awake to take advantage of every possible method of improvement.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. The report of the Curator for the month of October indicates the usual cultural operations in the Experiment Station. Plant distribution included the following: limes, 3,050; cacao, 200; grafted mangoes, 9; budded citrus, 40; shade trees, 600; miscellaneous, 21; making a total of 3,920. In addition, 174 packets of vegetable seeds were sold. In the Botanic Garden work was of a general routine character. In relation to staple crops, Mr Jones says that an excellent second crop of limes is now being gathered on some estates. The price of fresh limes remains at 8s. per barrel, and ripe limes at 6s. per barrel. The cacao crop is late, and generally speaking, not very promising. Fifty-six boxes of limes, 8 boxes of grape fruit, and 4 boxes of oranges were shipped to London for the use of the wounded in hospitals. The weather for the month was fine; the rainfall equalled 2.46 inches. The dry spell is said to be much appreciated after several months of wet weather.

MONTserrat. Mr. W. Robson reports work of a routine character in the Experiment Stations during the month of October. The following plants and seeds were distributed: 3,650 bay plants, 200 lime plants, 47 Andira for a wind-break, and 15 packets of various beans. In the Botanic Gardens four distillations of bay leaves were made, being a total of thirty-five distillations for the year. The yield of oil rose to 20oz. per 100lb. of green leaves on two occasions. The plot of American horse-mint is making moderate growth.

In his observations regarding staple crops, the Curator says the reaping of the cotton crop from most of the early planted fields has been practically completed; the crop from the late planted fields does not give very good promise. In some cases a start has been made to destroy the old cotton plants. The indications are that the percentage of lint will be relatively high in the present season. The Government's action in taking over the cotton crop has been well received, except in the case of those buyers of seed-cotton who paid 10d. per lb. for it. On the real situation as to the probable prices for lint on the market becoming known, the price for seed-cotton locally immediately fell to 7d. per lb. Regarding pests, no particular trouble has been experienced with disease on the cotton crop, and it remains to be seen whether the ample rains at the close of the month will encourage the development of a second crop of cotton. Three hundred samples of seed-cotton were examined in connexion with the cotton breeding experiments, leaving about 250 more to be examined. The onion seed (290 lb.) ordered some time previously, arrived at the close of the month. Dry weather was experienced during the month until the 28th, between which date and the 31st, 4.14 inches were recorded. The rainfall at Grove Station for the month was 6.90 inches; for the year, 60.75 inches.

ANTIGUA. The following plants and seeds were distributed from the Botanic Gardens during the month of October: miscellaneous and decorative plants, 44; onion seed, 650 lb.; vegetable seeds, 155 packets, cotton seed, 25 lb.; miscellaneous seeds, 5 packets. The work in the Botanic Gardens was of a routine nature; towards the end of the month a considerable number of plants were put out in beds and borders.

The cane crop in the Windward and Central districts of the island continues promising, the crop growing in the western and northern parts of the island is not so good. Exceedingly dry weather was experienced during the first

three weeks of the month, but rain which was required fell during the last week. On the whole, the cotton crop is late: the earlier planted cotton looks promising. Onion seed for the coming crop arrived during the latter part of the month, and was immediately distributed and planted at once on estates. Experiments were conducted during the month in the grinding of corn meal locally. In regard to pests, Mr. Jackson states that several attacks of caterpillars on cotton were experienced during the latter part of the month. For the Antigua Cotton Growers' Association 610 lb. of seed cotton were purchased. Five plots of land were taken up by peasants at Sawcolts during the month. The rainfall for the month was 2.54 inches; for the year, 31.78 inches.

Attached to Mr. Jackson's notes is a short report by Mr. A. Gallwey, on the work of agricultural instruction during the month of October. From this the following particulars are of interest: During the early part of the month the harvesting of the corn crop throughout the district was brought to a close. A part of this was purchased by the Government Granary, the remaining portion being bought by various estates. The cotton crop presents a fine appearance, and under the influence of the good rains which fell during the latter part of the month, steady progress has been made. Slight indications of the presence of cotton caterpillars were noticed on certain portions of one or two fields; these were dusted in the usual manner. Up to the present but few plants have been attacked by leaf-blister mite. Cotton stainers have not been observed in any of the fields. A splendid stand of black-eye peas has been obtained. Difficulty in establishing this and other crops of a similar nature is usually experienced owing to the depredations of slugs. Some three or four peasants in the district have combined and purchased 3 lb. of onion seeds.

ST. KITTS. Reporting for the month of October, Mr. F. R. Shepherd, Agricultural Superintendent, states that the usual routine work was carried on in the Botanic Gardens. Much watering was needed owing to very dry weather. Large numbers of ornamental cuttings were planted for a hedge in the cemetery. Plant distribution included 20 plants of *Quebrachia Lorentzii*, and 177 ornamental plants and cuttings. A barbed-wire fence has been erected to the east of the nursery, which improves the general appearance. In the Experiment Station planting operations were carried out, and the following seeds distributed: 10 lb. white velvet beans, 4 lb. Para peas, and 2 lb. Mazzagua Guinea corn. In regard to the staple crops, Mr. Shepherd states that the continued dry weather of the past month seriously affected the cane crop, and the prospects for next season are poor. Arrowing has commenced to a large extent, especially in the Valley district. Showers fell during the last few days of the month, and fairly heavy rains were experienced in the north-west districts, but heavy and constant rains are needed to do any real good in the Valley district and the estates connected with the factory. Planting of the next cane crop has begun on many estates, and the germination so far has been good. The cotton crop has nearly all been reaped, especially where planted early. The general returns have been disappointing: only in special cases have good yields been reported. This Mr. Shepherd attributes to the dry weather experienced in the early stages, the plants not growing sufficiently before bearing. The work in connexion with cotton selection and counting of flowers has been continued. Visits were paid to West Farm estate in connexion with the laying out of lime experiments. There was a meeting of the Agricultural and Commercial Society on October 2, at which the results of the reaping of the sugar-

cane varieties in the past season were submitted by the Agricultural Superintendent. The rainfall for the month was 2.91 inches; for the year, 33.31 inches.

Appended to this report is a summary of work conducted at the Government Laboratory, St. Kitts, during the month of October. This includes analyses of thirteen samples of milk from the Inspector of Police, work in connexion with cotton experiments, examination of lint, etc.

NEVIS. In his report for the month of October, Mr. W. I. Howell, Agricultural Instructor, states that 90 lb. of black-eye peas were distributed amongst peasant cultivators, together with 11 lb. of Paris green.

The cane crop is looking a little better, and preparation for the next crop is in progress. The cotton crop throughout the island continues to do well, and good yields are being obtained. The provision crops continue to do well; reaping the potato crop is in progress. Special efforts are being made to induce the growers to put in a fair acreage at this time so as to have a supply for March and April next. Spraying experiments are being carried out with coco-nuts at Pinneys estate. The rainfall for the month was 5 inches; for the year to date, 39.90 inches.

TORTOLA. The work in the Experiment Station during the month of October, writes Mr. W. C. Fishlock, Curator, was mainly of a routine character. The replanting of young coco-nut trees destroyed in the gale was completed. The following plants and seeds were distributed: cotton, 201½ lb.; potato cuttings, 725; lime plants, 3; coco-nut plant, 1; palms, 18; vegetable seeds, 2 packets.

The cotton crop, owing to unfavourable weather, will be late, but as more interest has been displayed since the rise in price, a fairly good crop is anticipated. Food crops, that is, ground provisions generally, are not yet in full bearing. Regarding pests, cotton worms have been reported in one or two cases, but none have been seen in the Experiment Station. The weather during the month continued unfavourable. Rain fell on eighteen days, the total fall recorded at the Experiment Station being 3.52 inches, as compared with 7.39 inches, the average for the month for the previous sixteen years.

The accounts having been closed and sent to Antigua for audit, it is hoped to pay out the bonus for the cotton crop for 1916-17 at an early date.

ST. VINCENT. The Agricultural Superintendent, Mr. W. N. Sands, reports work of a routine nature in the Experiment Station in connexion with records of cotton and peas experiments during the month of October. Work in the Botanic Gardens and nursery was also of a routine nature. Generally it may be said that the condition of staple crops was satisfactory. On some estates bush-bugs had damaged severely cotton and black-eye peas cultivations. This matter was being investigated by the officers of the Imperial Department of Agriculture and the local Department. Cotton stainers were few in number. The corn crop has been reaped; the surplus was either sold to the granary or to a local buyer for shipment to the United Kingdom: 15 tons were shipped during the month to the United Kingdom.

The Imperial Commissioner of Agriculture arrived in the colony on October 4. With the Agricultural Superintendent he visited the Government Ginnery and Granary, and Experiment Station on several occasions. Sugar and syrup propositions were discussed with owners of estates at Cane Grove. On the 10th instant Orange Hill estate was visited, sugar and coco-nut cultivations and sugar works were inspected, and matters connected with crops discussed. A meeting of the Agricultural and Commercial Society was held at the Court House

on the 12th instant under the Presidency of His Honour the Administrator. Sir Francis addressed the meeting on cotton and sugar-cane questions. Sir Francis left for Barbados on the 16th. Mr. W. Nowell, Mycologist of the Imperial Department of Agriculture, arrived on the 18th to study boll diseases of cotton. The Agricultural Superintendent has arranged for the purchase and shipment of 162 bales of Sea Island cotton to the Admiralty.

The weather during the month was seasonable. The rainfall recorded at the Botanic Station was 11.15 inches, and at the Experiment Station, 10.33 inches.

AGRICULTURE IN BARBADOS.

The total rainfall for November would have been sufficient to keep vegetation in a fairly vigorous condition if it had been well distributed, but the effect of a downpour is detrimental, if it is not followed by showers of at least a moderate character. In addition to the absence of rain during the past fortnight, the days have been perhaps the warmest we have had for the year.

A start has been made with the planting of the cane crop for 1918. During the past fortnight many acres have been planted both in the red soil and the black.

Some estates are cutting their own plants, while others are purchasing to a greater or less degree from their tenancies, and planters have told us that they are getting very healthy plants from their tenants.

The starting of the planting season does not mean that tillage has been completed in all fields. Ploughing, forking, manuring, and even the digging of cane holes are still in progress. There is also the forcing of manure in some fields, and some of these pens will, in all probability, not be ready for distribution before January next year. Some fields too, which are to be put under canes at this season, are at present under potatoes which cannot be removed until the beginning of December. This is inconvenient, but it is unavoidable owing to the crisis through which we are passing.

During the last fortnight our attention has been drawn to the brown hard back beetle known as *Phytalus Smithi*, which appears at this season in large numbers in some districts. This insect is a destructive sugar-cane pest, and should be systematically collected, in order to keep it under control. On one or two estates in St. Philip this is being done, and several hundred thousand beetles have been caught already this season. We suggest that on every estate where this pest appears a campaign should be started against it.

Ground provisions are at practically the same prices as at the date of our last report. The breadfruit crop has been a fairly plentiful one, but it is nearly over. The Indian corn crop has not been as abundant as last year, and the price has been maintained at 8s. per bushel.

The cotton crop is almost a negligible one, but the trees are healthy and are blooming well. Weather conditions have suited this plant. In spite of the high price of sugar, we would suggest to peasant proprietors in the sea-board districts that they should plant their holdings in cotton in preference to cane. We often see plots of canes in these districts which, when the season has been unfavourable, are scarcely worth the reaping; whereas a cotton crop is not thus affected by a dry season. There is also the fact that the land is sooner available for a crop of ground provisions than when it is put under canes. (*Agricultural Reporter*, November 17, 1917.)

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number continues to discuss the question of interest in education, especially in secondary schools.

On pages 372 and 373 will be found short reviews of (1) the Report of the Agricultural Department, St. Kitts-Nevis, 1916-16, and (2) the last report on sugar-cane experiments in Barbados.

Under Insect Notes, on page 378, there is a serious warning with regard to the possibility of the introduction of the pink boll worm of cotton into these islands.

Philippe de Vilmorin.

By the death of this well-known horticulturist on June 30, noticed in *Nature*, October 4, 1917, a brilliant figure has been removed from the horticultural world—one that science can ill afford to lose. Head of the great firm of Vilmorin, Andrieux & Co., probably the greatest seedsmen in the world, de Vilmorin placed its resources freely at the service of the science to the interests of which he was devoted. His experimental researches on Mendelian lines are well known, and of great value. He took advantage of a great opportunity to further his earnest desire to bring practical and scientific workers into close contact with one another for their mutual profit, by undertaking the work of Secretary to the Fourth International Congress on Genetics, which met at Paris in 1911. We may mention that through him a bronze medal was sent to the Imperial Department of Agriculture for the West Indies from that Congress, in recognition of the Department's work in investigations concerning plant problems in the tropics. De Vilmorin assisted in the progress of horticulture in many directions. He was also responsible for important publications of his firm, standard works on flower gardens, and also for a valuable report on rare and little-known plants tested by the firm. No man ever helped more to bridge over the gulf that seemed to exist between the horticulturist and the scientific botanist. Such success in this direction as has already been achieved owes much to Philippe de Vilmorin.

The Green Lime Trade of Dominica.

According to the *Colonizer*, May 1917, almost every lime consumed in New York comes at present from Dominica, but it is hardly to be expected that the Americans will not develop an industry of their own in this product in American tropical territory. Large areas in fact are being put under limes in Porto Rico, and considering that Porto Rico is at least a day or two nearer New York than Dominica, it is quite possible that a Porto Rican extension of this industry may have an injurious effect upon the Dominica trade. The demand will no doubt continue to expand, and there will be room for fruit from both islands, but it is almost certain that limes from Porto Rico would be placed on the New York market in a better condition than those from Dominica. A very high percentage of the fruit might reach the consumer in a perfectly green condition, and not in a yellow, and sometimes quite overripe state.

The American, like the West Indian, knows the difference between a green and a yellow lime in a beverage. The flavour of the green rind is a very important factor, therefore a green lime is preferred, and will command a better price. It would be well for Dominica shippers to give these facts careful consideration. Meanwhile every care should be taken to ship only sound, well graded, and freshly picked green limes, in order to maintain as high a standard as possible in the New York market, for the Dominica fruit is at present recognized, when compared with limes from other places, as superior to all others.

Production of Essential Oils in India.

There are immense plantations of *Eucalyptus globulus* in the Nilgiri hills in India. In spite of this, and the simplicity of the distillation of the essential oil from the leaves, large quantities of the oil are imported from Australia. Mr. Puran Singh, Chemical Adviser to the Indian Forest Research Institute, has issued a report on the prospects of this industry in India in *Indian Forest Records*, Vol. V, Part 8.

His conclusions are that the industry is capable of great development, if means can be found for increasing the leaf supply without resort to the Australian system of 'lopping' the trees. Mr. Puran Singh also advocates the cultivation of *Pelargonium graveolens*, a native plant, for the production of geranium oil as an auxiliary crop for the use of eucalyptus oil distillers, both plants being suited to the conditions of the Nilgiris, and the same distilling plant being capable of employment with either.

A New Hibiscus.

There are about 150 species of Hibiscus known, several of which are among the most showy of garden plants, notably, *H. Rosa-sinensis*, which in its many varieties, single and double, ranging in colour from brilliant scarlet through shades of red and yellow to almost pure white, is such a favourite plant in tropical gardens. The *Field* for October 20, 1917, describes another species under the name *H. waimeae* which has been introduced into conservatories in England from Hawaii by way of California. A large example of the plant, some 15 feet high, has recently been flowering in the Mexican house at Kew. It is described as growing into a tree 25 feet in height, with large, ovate, toothed leaves, and flowers over 6 inches wide, with pure white petals, and the long central column of stamens coloured bright-red. Plants of it grown in pots formed shapely specimens about 3 feet high and flowered freely in a greenhouse. It is said to be as easily grown as its near relative *H. Rosa-sinensis*, and is evidently a handsome shrub. It might be capable of producing, when crossed with the latter, a series of fine hybrids. Another species, also alluded to in the same article in the *Field* is *H. syriacus*, which is said to be quite hardy in the English climate, forming a large shrub in sunny situations, and flowering freely in late summer. Like *H. Rosa-sinensis*, there are many varieties of this species, single and double, white, pink, red, purple, even to almost pure blue in colour. This last shade is most unusual in flowers of this genus. Both of these species might be desirable acquisitions for West Indian gardens as companions to those which are already grown.

Standardized Rubber for Trinidad.

In a recent report, the Rubber Committee of the Trinidad Board of Agriculture states that while the rubber industry is not likely to occupy so important a position as cacao, sugar, or coco-nuts, it should nevertheless be quite as important as such crops as limes, rice, and coffee.

The quantity of rubber shipped from Trinidad from January 1 to August 1, 1917, amounted to 12,102 lb. as compared with 5,063 lb. for the same period of the preceding year.

Among other recommendations of the committee is that tapping methods be standardized, and that the basal 'V' method be adopted on young trees, to be followed later on by a single cut on a quarter of the circumference of the tree.

Co-operation among rubber growers is strongly advocated for the purpose of purchasing tapping tools and cups, so as to minimize thereby the cost.

Another recommendation is that earthenware cups be employed rather than those of tin, because of their immunity from rust, and because, being made without angles, they can be more easily cleaned.

The committee are of opinion that such standardization of methods, coupled with co-operative production, would result in rubber of uniform and superior quality, thus tending to place the industry on a secure basis.

International Sugar Committee.

Early in October the Food Administration of the United States appointed an International Sugar Committee to regulate the distribution of sugar to the allied countries, and to supervise the operation of the sugar market. Cuba, in spite of being the largest sugar producer in the world, upon whom the Allies are depending for their supply of sugar, was not represented on this committee. The confidence of the sugar producers of the island that the Food Administration would act fairly by Cuba in fixing the price of sugar has been somewhat shaken by the delay that took place in setting the price for Cuban sugars. The cause of this delay is said to be the slowness of the sugar producers of Western Cuba in sending in complete data showing the cost of production per pound of sugar at their various factories. Most of the data as to cost of production in the hands of the Food Administration of the United States is from the Centrals in Oriente and Camaguey Provinces, where the average cost of production of a pound of sugar is considerably lower than that in the Western Provinces of the island, so that a price based on these data would be ruinous to many sugar producers in the latter region. This is another instance of how lack of co-operation in an industry is productive of serious inconvenience if not loss.

Plant Protection in St. Lucia.

On September 20, 1917, the Administrator of St. Lucia issued a Proclamation forbidding the importation into the colony of any plants, cuttings, fruits, or any parts thereof, belonging to the natural order Gramineae, that may have come, either directly or indirectly, from Trinidad or Grenada, except under special licence given by the Governor. A note to this Proclamation states that it is issued to protect the St. Lucia sugar industry against the introduction of the froghopper, which lives on almost any kind of grass as well as sugar-cane; therefore the whole grass family has been included within the Proclamation.



INSECT NOTES.

THE PINK BOLL WORM.

In the last number of the *Agricultural News* some account was given of the habits of the larva of the pink boll worm (*Pectinophora gossypiella*) under various conditions, and attention was called to the rapid spread of this pest in Mexico and Brazil, into which countries it has recently gained entrance owing to the importation and distribution of infected seed without a thorough inspection. In view of the presence of this pest near the Mexican-United States border, as mentioned in the last issue, its introduction in the Southern United States would appear to be only a matter of time, in spite of the fact that every possible precaution is being taken to prevent its passing the border.

Now that the pink boll worm is well established in the New World, it is not at all improbable that it will at some future date spread to the cotton-growing islands of the West Indies. It was stated by Ballou in the *Agricultural News* (Vol. XIV, No. 346), that the pink boll worm would undoubtedly prove as destructive in the West Indies to the cotton industry as any pest has ever been to cotton in any country, which is equal to saying that the pink boll worm would most likely put an end to the cotton industry in any West Indian island where it becomes established. Our subsequent knowledge of the habits of this pest, of the rapidity with which it spreads, and of the ravages of which it is capable, only serves to strengthen the above statement.

The importance of the pink boll worm as a cotton pest of the first rank has for some time been recognized by the Imperial Department of Agriculture for the West Indies, and the question of prohibiting the importation of seed-cotton and cotton seed into these islands had already received thorough consideration. As soon as the information of its presence in the New World was received, the machinery for imposing the necessary restrictions was set in motion, with the result that a strict quarantine against this pest is now established in nearly all the British West Indian islands, both cotton-growing and non-cotton-growing colonies. Some details of the procedure followed in this instance may be of interest.

It may be noted that the British islands of the Lesser Antilles are for purposes of administration divided into two groups, the Leeward Islands in the north, and the Windward Islands in the south. Trinidad and Tobago constitute a third group for governmental purposes. The first step towards the quarantine of the pink boll worm taken by the Imperial Commissioner of Agriculture consisted in writing to the Governor of each of these three groups advising him of the serious menace which the pink boll worm now presents to the cotton industry in the West Indies, and strongly recommending that the importation of cotton seed and seed-cotton be prohibited from all places outside the particular group. Each island has its Plant Protection Ordinance or Act, and proclamations were immediately issued stopping the importation of cotton seed and seed-cotton from all places outside the group to which the island in question belonged. In some islands the Ordinance

allows the importation of small quantities of seed-cotton for experimental purposes under a special permit.

As soon as the prohibition was in force in each island of the above three groups, it was then a simple matter to modify the restrictions put on the importation of the above two commodities, so as to allow of the interchange of cotton seed and seed-cotton between the conforming groups of islands.

It will be found that as a general rule the imposition of these restrictions will entail no hardship to cotton growers in these islands, since each cotton-growing colony has within the past few years been able to develop a good strain of fine cotton, and if for some reason or other there happens to be a scarcity of seed for planting in any island, this commodity can, under the modifications of the Ordinances, be imported from any other island within the conforming groups.

At present no action has been taken as regards Barbados, which forms a fourth separate colony. The situation is complicated there by the fact that there is a large importation of cotton seed into the island for the purpose of manufacturing cotton-seed oil. Since the West Indian supply of seed is insufficient for the purpose, it is necessary to import this commodity from outside sources, including South America. There is at present no trade in cotton seed or seed-cotton from Barbados to the other West Indian colonies, nor does there appear to be any need for such a trade, since, as previously mentioned, each cotton-growing island has developed a good strain of cotton usually sufficient for its own needs.

So far as is known at present, the islands of the Lesser Antilles belonging to foreign nations have not taken precautions against the introduction of the pink boll worm, but the hope is confidently expressed that they will see their way to imposing the necessary restrictions, and making it as difficult as possible for this pest of cotton to gain an entrance into these islands.

J.C.H.

HOG CHOLERA OR SWINE FEVER.

The possibility of a large increase in pig raising in the West Indies was the subject of a paper by the Imperial Commissioner of Agriculture contributed to the *West Indian Bulletin*, Vol. XIV, p.221, and the matter has since then been frequently attended to in the pages of the *Agricultural News*, see for instance, Vol. XIV, p. 118. In connexion with this matter it is well to point out that the keeping and raising of pigs in large numbers is not without its risks, which are minimized by proper feeding and proper sanitary arrangements in pens, yards, and pastures, together with precautions against infectious diseases.

Among these by far the most deadly is the disease known in the United States as hog cholera, which is evidently the same disease as swine fever in England. According to *Farmers' Bulletin* 834, of the United States Department of Agriculture, issued in August 1917, hog cholera destroys about 90 per cent. of all hogs that die from disease in the United States. The losses from this cause have amounted to between 6,000,000 and 7,000,000 hogs in one year and the money loss has averaged probably more than \$30,000,000 a year for the last forty years. Especially is the loss heavy in the States of the Middle West, where hogs are reared in greatest numbers. In 1913 and 1914, when the disease was exceptionally prevalent, in some localities the industry was practically destroyed.

In England also the seriousness of swine fever is shown by the fact that in 1914, according to the *Journal of the Board of Agriculture* for July 1916, the total number of

hogs which died from the disease, or were slaughtered because of being infected, was 59,185.

Even in the West Indies, where hogs are not as yet kept in large herds, the disease has been in some instances very destructive. The writer remembers that some years ago there was an outbreak of hog cholera in Antigua, which caused serious loss to the keepers of hogs in that island.

Hog cholera is a highly contagious disease of swine caused by a living micro-organism or germ, so small that it cannot be seen even under the highest power of the microscope. But that it is a living agent is proved by the fact that if liquid containing infective matter be passed through the finest bacteriological filter, a very small amount of the filtrate will produce the disease in a pig into which it has been injected, and the infecting agent will increase in the pig's system in a short time to such a degree as to be capable of infecting more than a thousand other pigs. So far as is known the disease does not, however, affect other animals or human beings. Although insanitary surroundings and improper feeding tend to lower an animal's vitality, and so perhaps render it more susceptible of disease, yet such conditions cannot of themselves cause hog cholera. It can only be produced by the specific micro-organism.

There is another disease of hogs, swine plague as it is called in the United States, which is different from hog cholera, but so closely associated with it that one disease seldom appears without the other. Swine plague is an infectious pneumonia which attacks swine when in poor condition, or when run down by an attack of hog cholera. Professor Nelson S. Mays in his book 'The Diseases of Animals', says it is probable that germs of swine plague are widely distributed wherever hogs are kept in large numbers, but the natural power of resistance in the system of a healthy animal is sufficient to prevent these germs from developing after entering the system. When, however, the system becomes weakened, the germs develop, and death often results, not only directly from the pneumonia, but from the hog cholera with which swine plague is usually connected. The difficulty of distinguishing these two diseases is so great that it is well to treat suspected swine plague as if it were a case of hog cholera.

As was stated above, hog cholera, so far as is known, can only be communicated by the introduction of the specific germ of the disease. There is therefore no more certain way of introducing hog cholera than by placing an infected hog along with others. Infected hogs discharge the diseased germs from their bodies not only in their urine and faeces, but even in the secretions of the mouth, nose, and eyes. It follows, therefore, that the bedding and litter, and even the dirt itself in pens where an infected animal is kept must be infected with the germs. These germs may enter another hog's system by means of food and drink, and probably also through wounds or skin abrasions. It is stated that the germs possess great vitality, so that a locality where hog cholera has broken out may remain infected for a long time.

As to precautionary measures against this disease, they may be summed up in a few lines. Careful attention to see that the hogs are properly fed and supplied with pure water; clean and sanitary quarters; and lastly, all possible precautions against the introduction of an infected animal among other healthy ones.

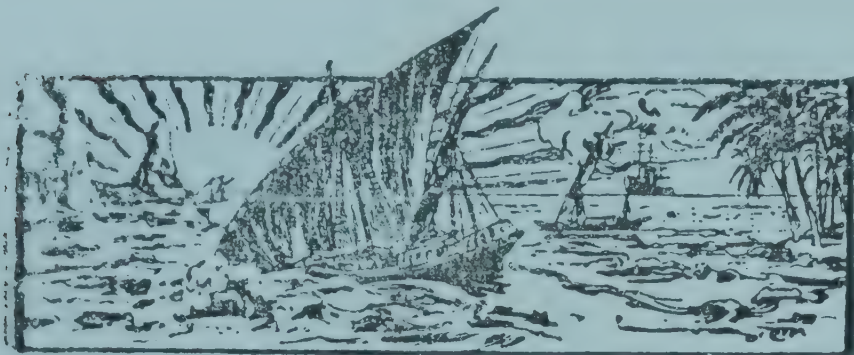
Up to the present time, the *Farmers' Bulletin* referred to above states, no drug or combination of drugs is known which can be regarded either as a preventive or a cure in the true sense of the word for hog cholera. Only one agent known can be regarded as a reliable preventive, that is anti-hog cholera serum, prepared from the blood of an immune hog which has been inoculated with the blood of

a hog suffering from the disease. The efficacy of this serum as a protection was first brought to public notice by the Bureau of Animal Industry in the United States in 1908. Its value is now also generally recognized in England and in many other countries. While looked upon as most efficacious when administered as a prophylactic, the serum has also an undoubted curative value if administered in the early stages of the disease.

One great advantage of this treatment is that, as the serum does not contain any germs of hog cholera, it may be safely employed to guard against the introduction of the disease. The method of injection is a simple one, by means of a hypodermic syringe. This treatment is to be recommended in preference to any other for treating sick hogs. Unfortunately it does not render healthy hogs permanently immune. The period of immunity conferred by an injection seems to last from about four weeks to two or three months, varying according to the peculiarities of the individual hog, and also to some extent according to the size of the dose, which is graduated from a dose of 10 cubic centimetres for a small pig weighing less than 10 lb., up to one of 80 cubic centimetres for a hog weighing 175 lb. or more. Ordinarily, the treatment of hogs already infected by hog cholera with injections of serum alone is efficacious in the early stages of the disease, but has only a slight effect when the disease is advanced.

Complete immunity from the disease is obtained by the injection of hog cholera virus in addition to the serum. The practice is to administer the germs of hog cholera in the virus, and at the same time to give a dose of serum, which will protect the hogs from cholera. The theory is similar to that of vaccination. The *virus* entering the system of the hog causes a reaction, which results in an immunity like that found in hogs which have recovered from a natural attack of the disease; the *serum* given at the same time renders the attack thus artificially produced a mild one, and so the hogs thus treated are rendered immune for their natural life. There is, however, the danger in this treatment that, if the work is not done properly, or a sufficient dose of serum of sufficient strength not administered along with the virus, a serious case of hog cholera may be produced by the latter. Although the treatment with serum alone is simple enough for any intelligent man who will follow the instructions supplied, to undertake, yet it is agreed that the simultaneous inoculation of virus and serum should only be practised by competent veterinarians, who have had adequate training in such questions. The conclusions to be remembered are put in very few words by the *Farmers' Bulletin* already quoted: if hog cholera appears among a herd, (1) isolate all sick animals; (2) use serum, which is manufactured in several State institutions, and by private firms licensed for the purpose by the Secretary of Agriculture of the United States; (3) employ stringent disinfecting measures; (4) submit to a voluntary quarantine of your premises.

Science Teaching in the Antigua Grammar School.—Apropos of the question of the stimulation of the interest in education, especially scientific education in secondary schools, which is the subject of the editorial in the present issue of this Journal, an article by Mr. S. T. Christian, B.A., an Assistant Master in the Antigua Grammar School, in the issue for Trinity Term of the School's *Review*, gives an interesting summary of what has been done for the teaching of scientific subjects in the school since its foundation in 1884. The article in question is valuable as placing on record the work done in this direction, and the assistance given to this side of education by the Imperial Department of Agriculture, as well as by the local Government.



GLEANINGS.

In *Colonial Reports*—Annual, No. 930, it is recorded that petroleum oil was third in value on the list of the exports of the Colony of Trinidad and Tobago in 1916, the value of crude petroleum, fuel oil, and gasoline exported during the year being over £200,000, as compared with £79,000 in the previous year.

Dr. Garnet, Chairman of the Education Reform Council inaugurated by the Teachers' Guild, in a foreword to the report of the Council published in 1917, makes the remark that 'the fate of a nation is not likely to depend on the appreciation of music, art, or literature by its rulers, but it may well hang on their appreciation of science.' (*Nature*, September 27, 1917.)

Very serious damage is reported to the Sea Island cotton crop by the boll weevil around Valdosta and throughout Southern Georgia, where a very large percentage of the crop is grown; it is estimated that only one-fourth of a crop will be made in this section. There has been some increase in acreage in other sections, which will partly offset this damage, but crop estimates are much reduced. (*The India Rubber World*, October 1, 1917.)

The hurricane which passed over Western Cuba at the end of September did an enormous amount of damage, according to the *Louisiana Planter* of October 6, to the crops in the Province of Pinar del Rio, and the Isle of Pines. The fruit crops are ruined, and the cane crop is damaged to some extent. The cane crop, of course, is not completely ruined, although the loss in some places is estimated at about 40 per cent. The tobacco crop has also been almost completely destroyed.

A new celluloid product called 'Satolite' has been invented by Mr. S. Sato, Assistant Professor in a Japanese University, and the Satolite Company has been established for its manufacture with a capital of 2,000,000 yen (yen = 2s. 0½d.). Satolite is a galalith made of glucine of soy bean coagulated by formalin. It is said to be produced much cheaper than ordinary celluloid, and to have more merits in its use than the latter. The actual manufacturing, it is announced, will begin this autumn. (*The India Rubber Journal*, October 6, 1917.)

The London correspondent of the *North Queensland Register* writes that from the earliest days of Queensland English potatoes have been profitably grown there. The Queensland grower has the advantage that he can produce two crops in a year, averaging about 4 tons per acre, but reaching as much as 8 tons on the Darling Downs, thus giving an annual return of from 8 to 16 tons per acre. No very large areas are anywhere planted in the State, but in the aggregate the area is fairly large.

The *Board of Trade Journal*, October 4, 1917, states that the hurricane which passed over Jamaica in the last week of September destroyed almost all the bearing banana trees, but that on the whole, the situation of the industry is better than it was after the hurricane of 1916, because of the number of young trees which have not been destroyed. The damage done to coco-nut trees also in some of the parishes has been considerable. The cacao crop also in the eastern part of the island has been seriously damaged.

From the *Journal of the Board of Agriculture of British Guiana*, July 1917, it appears that a new hybrid bean has been produced by Mr. J. F. Waby. This is a cross between two varieties of *Dolichos lablab*, the well-known bonavist. It is said to be a stronger grower, and a more prolific bearer than either of its parents. Mr. Waby has named this hybrid *D. macrocarpa*. The beans are used as French beans before the seeds are formed, or if allowed to mature, the seeds are shelled and used as bonavists generally are.

The *Field* of October 13, 1917, has a short note on the South American snake-eating snake, the black Cribo (*Oxyrhopus cloelia*), which, although non-poisonous itself, evinces a partiality for eating the poisonous viperine snakes, such as the deadly fer-de-lance and the rattle snake, to the venom of which it is immune. The writer of the note describes in an interesting way the manner in which a common English viper was attacked and demolished by a specimen of the black Cribo now in the Reptile House of the Zoological Gardens.

The *Louisiana Planter* of August 25 contained a short article concerning agricultural conditions in St. Croix, which was entirely misleading. We are glad to see that in the issue of the same journal for October 13, Dr. Longfield Smith, Director of Agriculture in that island, publishes a letter correcting the misinformation conveyed in the former article, and giving a true picture of cane cultivation there. The fact is that St. Croix has been carefully cultivated for over 100 years. The land has been ploughed and forked and manured almost every year.

By a Proclamation of President Wilson, issued on September 7, it was stated that all permits for the manufacture of sugar would have to be obtained prior to October 1. Upon receipt of a copy of this Proclamation in Porto Rico, an extension of time for the Porto Rico centrals was requested, because it would be impossible for them to obtain permits prior to October 1. The Porto Rico sugar manufacturers believe that there will be no difficulty in their obtaining permits, even though they could not be obtained in the time specified by the President's Proclamation. (*The Louisiana Planter*, October 13, 1917.)

The following note in the *Journal of the Jamaica Agricultural Society* for September 1917, is of interest to fruit growers: 'The usual way to pick even delicate fruit from high trees is to shake them down and try and catch them as they fall. There is however an excellent fruit picker which seems to be an imitation of the human hand as held out to catch fruit; this can be placed at the end of a bamboo or of a stick, so that each delicate fruit may be safely brought down without risk of bruising.' This fruit picker seems to be very cheap, the price being only 2s. in Kingston.

COTTON EXPORTS FROM THE WEST INDIES.

The following figures supplied by Mr. W. C. Fishlock, Curator, Virgin Islands, represent the quantity and estimated value of cotton exported from these islands for the quarter ended June 30, 1917, and omitted in the return published in the *Agricultural News*, Vol. XVI, No. 402, p. 294:—

Kind of cotton.	Quantity, lb.	Estimated value, £.
a. { Sea Island	5,506	734
Native	1,170	88
Stains	460	34
	<hr/> 7,136	<hr/> 856
b. Seed-cotton, 5,400 lb. = 1 1/2	1,350	75
	<hr/> 8,486	<hr/> 931

a.—Cleaned lint shipped by the Government Factory.

b.—Seed-cotton privately shipped, quality unknown.

The quantity and estimated value of Sea Island cotton exported from the West Indies for the quarter ended September 30, 1917, is as follows:—

Colony.	Quantity, lb.	Estimated value, £.
Barbados	857	21
St. Vincent	nil	nil
Antigua	17,000	2,975
Montserrat	1,945	364
St. Kitts	29,327	4,399
Nevis	69,341	10,401
Anguilla	13,434	2,015
Virgin Islands	250	30
	<hr/> 132,154	<hr/> 20,205

Besides the above there were also shipped from St. Vincent 11,088 lb. of Marie Galante seed-cotton, of an estimated value of £115.

Included in the above figures for Montserrat are 361 lb. of stains valued at 1s. 6d. per lb.

The following table gives the quantity and estimated value of Sea Island cotton exported from the West Indies for the season October 1, 1916 to September 30, 1917:—

Colony.	Quantity, lb.	Estimated value, £.
Barbados	76,296	8,213
St. Vincent	99,688	11,669
Montserrat	314,281	35,678
Antigua	33,500	5,141
St. Kitts	106,265	12,184
Nevis	196,915	24,931
Anguilla	49,399	6,511
Virgin Islands	16,523	1,464
	<hr/> 892,867	<hr/> 105,791

Besides the above there were also exported from St. Vincent 19,656 lb. of Marie Galante seed-cotton, of an estimated value of £204.

The estimated production of St. Vincent was 160,168 lb., but a considerable quantity remained unshipped.

From the Virgin Islands were also shipped 1,170 lb. native and 460 lb. of stains, the estimated values of which were £88, and £34, respectively.

Owing to the lack of transport shipping facilities from the West Indies, a large quantity of cotton of the 1916-17 crop still remained on hand up to September 30, 1917.

A NEW GRASS IN THE WEST INDIES.

There is some danger attached to the introduction of new plants into any place where the conditions of soil and climate give the new introductions a particularly favourable environment. This is eminently so in the case of grasses, which, either from spreading rhizomes, or because their seeds are so constructed as to be easily distributed over wide areas, either by the agency of the wind, or by means of animal transportation, can soon overrun a considerable extent of country.

One of the most troublesome weeds to planters in many of these West Indian islands is 'devil's grass' (*Cynodon dactylon*). This grass, on account of its long creeping rhizomes, and its extraordinary vitality, can hardly be exterminated when once it has gained a footing in any field. It is a native of India, and is there cultivated as an excellent forage grass, which it is. Introduced from India, it is said, into the Bahamas, it has spread through these West Indian islands because it makes a fairly good lawn when mown and rolled, and is well adapted to tropical conditions. Sugar planters do not bless the introducer of this grass. In some of the West Indian islands it is not too much to say that the cost of cultivation would be lessened 25 per cent. if 'devil's grass' was not in possession of the fields.

The writer of this note has heard an old Antigua planter say that had the agricultural fork not largely taken the place of the hoe, sugar-cane cultivation would have had to be abandoned in that island on account of 'devil's grass'. By forking it is possible to turn up the rhizomes of the grass, and shake them out of the earth and burn them, thus exercising an adequate control on their growth. Bryan Edwards also, in his history of the West Indies, mentions an Antigua estate as in danger of going out of cultivation on account of the difficulty of controlling this grass. It is true, however, that it affords excellent pasturage.

The foregoing remarks have been instigated by observing that quite recently a new grass has been introduced into Barbados at least. Fortunately this seems to have considerable value as a forage grass, but so has *Cynodon dactylon*. This new grass is known to botanists as *Tricholaena rosea*. It is a native of South Africa. From thence it has been spread into Brazil, and now into the West Indies, at least into Cuba and Barbados. In Cuba it is known, according to Hitchcock and Chase, the authors of 'Grasses of the West Indies', as 'Natal' grass. In Brazil it is called 'Favorita'. This last name is not inappropriate, for the grass is very beautiful. It grows about 2 feet high, and produces a beautiful rosy-bronze inflorescence. A bed of it is a striking object, and the flower spikes are very effective among other flowers for table decoration. In Natal and in Brazil it is cultivated as a good hay crop. Whether it will prove of value in this particular in the West Indies remains to be seen. It is certainly now acclimatized, and, as far as the writer's observations have gone, it is capable of holding its own among grasses of a similar habit, such as the Barbados sour grass (*Andropogon pertusus*). Grasses of forage value, like this *Tricholaena rosea*, may be of benefit as giving a mixture in forage or hay. Perhaps this grass which has been introduced as an ornamental grass, in gardens, may prove to be not only ornamental but useful.

STORY OF AN EFFORT TO INTRODUCE USEFUL PARASITES.

Under the heading Biological Studies applied to Agriculture in the last issue of this Journal, reference was made to the White Fly of Florida (*Aleurodes citri*), its ravages among the citrus plantations of that State, and the marked degree of success in controlling its attacks which resulted from cultivating and disseminating certain fungi parasitic on this scale insect. The means of control of the technical kind have also been found useful, notably the fumigation of trees effected with hydrocyanic fumes, and also the spraying of them with chemical insecticides, but both of these need to be frequently repeated, and are expensive.

In the account of M. Marchal's scientific visit to the United States, from which the article referred to was for the most part translated, there is given a very vivid and interesting story of an attempt made by the orange planters and Government of Florida, with the co-operation of the Bureau of Plant Industry, to obtain and acclimatize other parasites, especially insects, which might prove an even more efficient control than the means hitherto adopted. This story is worth telling as an example not only of the perseverance which the scientific men of the United States devote to a question of research, but also of the almost unlimited means placed at their disposal by an enlightened Government and an intelligent community in order to attain the end aimed at.

Aleurodes citri or White Fly is a hemipterous insect, closely allied to the Coccids or true scale insects. Of Asiatic origin, it began to be noticed in Florida about the year 1879, and was almost immediately recognized as one of the worst enemies of orange and lemon trees. A great reason for its rapid spread in the Southern States is that it can live on many other plants besides those of the citrus family, among which are several indigenous to that region. It accordingly spread through all the States bordering the gulf of Mexico, and before very long made its appearance in Californian citrus orchards also. Ballou, in 'Insect Pests of the Lesser Antilles', says that *Aleurodes citri*, though occurring in these islands is not a serious pest. He questions whether the species may not rather be *A. nubifera*.

The damage it causes to the trees in reduction of yield has been estimated at not less than \$500,000 in one year in the State of Florida alone. The damage is not only the result of the punctures made in the tissues of the leaves by the insect in order to extract the sap, but is also intensified by the fact that the insect causes the development of a sooty mould on the leaves and fruit of trees attacked, which interferes with the respiratory functions of those organs. The difficulty experienced in effectually controlling this pest arises, not from any special power of resistance which it possesses against chemical insecticides, for this is relatively feeble, but from its immense fecundity. It is computed that there are three generations in the year, and that each matured female lays from 100 to 250 eggs. Thus, in spite of efficacious spraying or fumigating, some few individuals must escape, and however few, they are quite enough to produce at the end of two or three generations a sufficiently numerous progeny to become again a menace to the citrus crop.

Seeing that the natural enemies of the *Aleurodes* in Florida were not sufficient to check the devastations of the pest, and considering that undoubtedly it had been introduced from the East, there arose a strong public opinion among the citrus planters of Florida that the best course to pursue would be to search in its original habitat for parasites on this pest, and to take steps to acclimatize

them in Florida. After some correspondence between the orange growers, the Bureau of Insect Pests at Washington, and the Experimental Station of Florida, the matter was placed before Congress, who passed a vote, allocating a special sum for research as to the original habitat of *Aleurodes citri*, for collecting any natural enemies of this insect, and for the acclimatization of them in Florida.

Mr. R. S. Woglum, one of the Entomologists on the Staff of the Bureau of Insect Pests was appointed to undertake this task. He left New York on July 31, 1910, and visited the citrus cultivations of Spain, Italy, and Sicily without finding any trace of *Aleurodes citri* or its parasites. He then proceeded to Ceylon, where again he could find no presence of this destructive insect. From Ceylon he went to Calcutta, and there in the Museum of Natural History he found specimens of orange leaves covered with *Aleurodes citri*, the label attached to them showing that they had been collected in the Himalayan region to the north-west.

Mr. Woglum immediately set out for this region, and at Saharanpur he found numerous orange trees with *Aleurodes* on them. These were, however, very scattered, and this presumed the presence of natural enemies. Soon after Mr. Woglum discovered some lady-bird beetles which fed on the *Aleurodes* both in the larval and adult stage. He sent two consignments of these lady-birds to Florida, packed in the best way he knew, but not one of them survived to reach Florida.

While in the neighbourhood of Lahore, Mr. Woglum obtained observations on, and specimens of, a small wasp (*Prospaltella lahorensis*) which preyed upon *Aleurodes citri*. Mr. Woglum had thus accomplished the first part of his mission. How to collect, convey to Florida, and acclimatize these helpful parasites, was the next question.

It was necessary to transport orange plants in full leaf, infested with *Aleurodes*, in order thus to provide food for the beneficent parasites on the voyage, which would take from India to Florida from five to six weeks. Mr. Woglum in the spring planted in pots orange plants from one to 4 feet high; then in September he placed them under orange trees infested with *Aleurodes*. Naturally the orange plants in the pots were soon badly infested. Not long after, the parasitic lady-bird and wasp made their appearance among the potted plants, and attacked their prey the *Aleurodes*. About the middle of October Mr. Woglum thought that it would be good to ship his young orange trees, covered with *Aleurodes* infested in turn with the larvae of the parasitic lady-bird and wasp, to Florida. Packed in Wardian cases the plants made a successful journey of six weeks duration from Lahore to Florida. So scientific and successful were the arrangements that a number of the predatory lady-birds and wasps were received alive at the entomological station of Orlando, Florida.

Unfortunately the climatic conditions in India at the season of shipment and those in Florida at the time of arrival did not coincide. These allies in the Florida war against *Aleurodes* arrived in Florida just when the foe was resting for the winter in the pupal form, in which it was not attacked by either of these allies, which attack only, either the larval form, or the egg. In consequence, before the next spring, all the predatory insects imported from India had perished from want of their prey.

This may seem as if much of the work in the direction of importation and acclimatization of beneficial insects was doomed to failure. These facts, however, only show that there is need for immense labour and care.

THE USE OF MACHINERY ON THE LAND.

In several recent numbers of this Journal attention has been directed to this subject. The following article from the *Field*, October 6, 1917, is reprinted as of great interest in this connexion:—

'The use of machinery on the land continues to increase and expand in all directions. The particular types of machines that excite interest at present are those designed for the cultivation of the land, which are provided in constantly widening variety and improving efficiency. The change in this respect since war conditions have obtained has been remarkable, and it becomes more pronounced as the need for new and speedier methods increases. The customs that answered in the less strenuous days of peace are retained, and are unlikely ever to be completely superseded, but owing to the diminished resources in men and horses, and the growing requirements of the country, special and supplementary arrangements have to be made for coping with the altered situation in a manner appropriate to the occasion. This need has brought into the field of agricultural activity mechanical appliances showing a diversity of design and construction that testifies to the care with which the requirements of the land have been studied, and the promptitude of the engineering firms in coming to the rescue of an industry hampered by war conditions, and yet essential to success in prosecuting hostilities.

'The distinguishing feature in the countryside this autumn is the conspicuous part played by machinery in performing the various tillage operations preparatory to the drilling of the winter cereals. The teams are doing their share with diligence and proved efficiency, but so urgent is the need for pushing on rapidly with the work that for the moment horse-power is rather overshadowed by the steam and oil appliances of which it can at least be said they cover the ground more quickly, a point of importance at a time when attention has to be concentrated mainly upon getting the work done. But while the results from horse-drawn implements may be uniformly more satisfactory, it would be unfair to the newer forms of traction to conclude that the work done by steam or oil is necessarily inferior or defective. If it be conceded that it is more variable it is equally true to say that in many instances the machine is superior to the horse because of its greater power to undertake the heavier operations, and to do more thoroughly the initial work of breaking the hard summer surface, and reducing the soil to the loose state that constitutes the best seed-bed. Steam tackle has long been regarded as the only competent power to deal effectively with the stronger lands, and this verdict has not been appreciably modified by the advent of the oil tractor. There is proof of this in the busy programme that has been arranged for steam plant between now and winter. It appears that every available outfit has been booked so long in advance that new applications can seldom be entertained. From all accounts twice the number of steam appliances would be required to satisfy the present demand.

'While the well-tried steam implements are doing excellent work on the fallows, stubbles, and clovers, and are rapidly reducing the arrears of tillage operations, the newer oil tractors are giving a good account of themselves in the classes of work commonly done by horses. It is no exaggeration to say that it is upon oil power that the country has to depend principally for the increase in corn production next year. The normal forces of the farm—horses and steam—cannot be sensibly increased, if, indeed, they can be maintained at peace-time strength, so that the oil tractor is the only new weapon upon which it is safe to count for the extended programme of corn growing that the nation expects.

A very short time back this would have been regarded as a rather unstable foundation upon which to build so important an expectation, but practical opinion regarding these machines has changed rapidly, and in a way that justifies confidence in the ability of the industry to fulfil in liberal measure the great task imposed upon it by the emergency needs of a nation at war provided of course the supply of tractors is adequate. It is believed that the oil tractor was destined in any case to occupy a useful place on the farm, but the war has given it an impetus that will hasten its progress. Necessity is an effective antidote to prejudice, and equally an incentive to enterprise in the introduction of new inventions, and the agricultural motor has benefited from the urgency of emergency methods of food production. The high favour into which tractors and motors have forced themselves as accessories in times of stress is a hopeful augury for important developments in after years. The prediction is warranted that just as necessity has expedited their introduction on a large scale, their general utility will secure for them a permanent and prominent place on the well-equipped farm in years to come. With increased experience in the adaptation of motor traction to the multiple duties of the land, the position of the farm motor will improve, and its value as an aid to economic production will grow in proportion. It would, indeed, be unsafe to fix a limit to the merits of the farm motor as an instrument of utility.

THE HEALTH OF RURAL SCHOOLS.

There have recently been received at the Head Office of this Department three pamphlets issued in the United States by the Joint Committee on Health Problems in Education of the National Council of the National Education Association and of the Council on Health and Public Instruction of the American Medical Association. The first of these, is entitled 'Minimum Health Requirements for Rural Schools', and deals mostly with the health problems of schools in the country; the second is entitled 'Health Essentials for Rural School Children', the object of which is to propose and recommend practical measures which seem necessary and possible for the health of children in country schools; and the third, entitled 'Health Charts', contains illustrations of charts which have been prepared by the Joint Committee referred to above. These charts present diagrammatically and pictorially important facts relating to health of school children and the health conditions of schools. We quote the following from the introduction to these pamphlets:—

'The country school should be as sanitary and wholesome in all essential particulars as the best home in the community. Further, it should be pleasing and attractive in appearance, in furnishings, and surroundings, so that the community may be proud of it; so that the pupils and teacher may take pleasure in attending school.'

These pamphlets may be recommended to the attention of Educational authorities in the West Indies, as, *mutatis mutandis*, valuable hints on the important subject of health among school children may be gleaned from them. It is stated that copies may be obtained on application from the United States Bureau of Education in Washington.

A note in *Nature*, October 4, 1917, states that a national institute is to be established in Italy, having for its object the investigation of the relations between malaria and agriculture, the study of the direct and indirect causes of the unhealthiness of malarial districts, and the organization of a campaign against those causes.

MARKET REPORTS.

New York.—Messrs GILLESPIE BROS. & Co., November 9, 1917.

London.—THE WEST INDIA COMMITTEE CIRCULAR, October 18, 1917.

ARROWROOT—5½d. to 5¾d.
BALATA—Venezuelan Block, 3/2½ to 3/5; Sheet, 3/9 to 4/-.
BEESWAX—No quotations.
CACAO—Trinidad, 95/-; Grenada, 90/-; Jamaica, 90/-
COFFEE—Jamaica, no quotations.
COPRA—£46.
FRUIT—Bananas, £40 per ton; Oranges, 30/-.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, 95/- to 105/- per cwt.
LIME JUICE—Raw, 2/6 to 2/9; concentrated, no quotations;
Otto of lime (hand-pressed), no quotations.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—4d. per lb.
RUBBER—Para, fine hard, 3/5; fine soft, no quotations;
Castilloa, no quotations.

CACAO—Caracas, 12½c. to 13c.; Grenada, 12¼c. to 12½c.;
Trinidad, 12½c. to 13c.; Jamaica, 9½c. to 10½c.
COCO-NUTS—Jamaica and Trinidad selects, \$59.00 to
\$61.00; culls, \$38.00 to \$40.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—16½c. to 20c. per lb.
GOAT SKINS—Jamaica, 80c.; Antigua and Barbados, 70c. to
75c.; St. Thomas and St. Kitts, 65c. to 70c. per lb.
GRAPE FRUIT—Jamaica, \$2.75 to \$3.50 per box.
LIMES—\$4.50 per brl.
MACE—38c. to 41c. per lb.
NUTMEGS—18c. to 19c.
ORANGES—\$2.50 to \$4.00.
PIMENTO—6c. to 6½c. per lb.
SUGAR—Centrifugals, 96°, 6.90c.; Muscovados, 89°, 6.64c.;
Molasses, 89°, 5.75c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., November 22, 1917.

CACAO—Venezuelan, \$11.25 to \$11.50 Trinidad, no quotations.
COCO-NUT OIL—\$1.30 per gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—7½c. per lb.
DHAL—No quotations.
ONIONS—\$8.00 per 100 lb.
PEAS, SPLIT—\$12.00 to \$12.50 per bag.
POTATOES—English, \$4.50 to \$5.00 per 100 lb.
RICE—Yellow, \$10.50 to \$11.75; White, \$9.25 to 9.50
per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 30, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MOLASSES—No quotations.
ONIONS—\$12.00.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$6.75.
RICE—Ballam, \$10.00 to \$10.80 per 180 lb.; Patna, no
quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, no quotations.

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Stimulation of Interest in Education.

IN this article it is proposed to deal with the relationship of local educational systems to technical training in agriculture, interest in the subject having been roused by the appointment in St. Lucia of a Commission to enquire into and to report upon educational matters. In two recent articles reference has been made as to how far questions relating to agricultural knowledge and practice can fairly influence the work in primary and secondary schools. In these articles it was pointed out that more or less successful attempts had been made to advance matters from time to time in various West Indian colonies, and some of the difficulties and limitations were pointed out; while it was agreed that much

remains to be done to put matters on a sound footing, and that the time for systematically considering the whole question is opportune.

The teaching to be given within the four walls of a school, though presenting difficulties, some of them serious, must proceed along fairly obvious lines, and have as its object the general education of the pupils in the strict academic sense. The requirements of daily life lead at times to a wish on the part of thoughtful people that the teaching in the school might more adequately fit the pupils for their duties in after life, and that at school they might learn something of the manner of carrying out the duties by which they may have later to earn their living. Hence we see attempts to introduce matters of commercial concern into the higher classes of some of the schools, shorthand, typewriting, and commercial correspondence being in some cases taught as school subjects. Some of these matters present little difficulty, and lend themselves fairly well to treatment as educational subjects in secondary schools.

This has led to the idea that the science subjects taught in the schools might be so developed as to give the pupils an insight into the working of land and the production of crops. It has been pointed out that the secondary schools cannot properly carry out these duties, and that it will be detrimental alike to the school and to the pupil to attempt to make technical agricultural training the subject of school work. It is admitted, however, that there is urgent need of this technical training in agriculture, that the youths of these colonies are sadly handicapped for lack of it, and that the progress of the colonies themselves is materially retarded thereby.

If one cannot look to the schools for relief in this connexion, there is good reason for thinking that recourse may be had to the several Agricultural Departments for assistance, particularly as regards training of youths leaving the secondary schools.

The Botanic Gardens and Experiment Stations, which are now part of the regular equipment of every West Indian colony, afford good training grounds for a limited number of pupils, who can there gain sound knowledge concerning matters of agricultural practice, and usefully bridge the time between leaving school and entering upon wage-earning employment.

A definite system is in vogue in this connexion, which has been described at length in the article in the *West Indian Bulletin* (Vol. XIV, p. 171), to which reference has already been made, and from which the following is reproduced:—

‘In some colonies it is possible to afford much useful training by using the Botanic and Agricultural Experiment Stations as training grounds for youths from the secondary schools, just as it is possible to use them for training pupils from the elementary schools. In some West Indian colonies where this scheme is in operation the term cadet is employed to indicate the student from the secondary school, the term agricultural pupil being reserved for the boy from the elementary school; it will be found in practice that distinctions such as this have their value.

‘During the first year of a cadet’s training he should remain closely associated with the secondary school, and should continue to attend such science classes as may be considered most likely to be useful to him; the remainder of each working day should be occupied in connexion with the practical work of the Botanic and Experiment Station. The situation of the Botanic and Experiment Stations near popular centres usually minimises the difficulties attendant upon this divided course. For the first year of his training, at least, a cadet should be regarded as within the jurisdiction of the school for purposes of discipline.

‘The kind of training a cadet may receive will depend upon the nature of the work of the Botanic and Agricultural Experiment Station of any given district, and this in turn will be determined by the nature of the agriculture of the surrounding district. This has its advantages, for the cadet will best find his work and training approximating closely to the requirements of the district in which he is placed, and in which he may probably have to seek employment;

and further, this amount of specialization permits of a cadet being able to spend some time in more than one institution, and so acquire, if necessary, a wide range of agricultural experience. The chain of Botanic and Experiment Stations established throughout the West Indies offers unusually good facilities for study and training, of which advantage is being taken.

‘The training of a cadet embraces the acquiring of some acquaintance with the manner in which the routine office work of the institution in which he is placed is conducted. He learns how correspondence is conducted and records are kept, and participates in this work. He acquires a knowledge of the various agricultural and horticultural operations carried on at the institution, and attains some skill in the practical carrying out of them. As his experience increases he is placed in charge of minor operations, and gradually advances to the supervision of labourers, and to responsibilities of a higher order. He also takes part in the experiments and investigations which are undertaken by the institution, and learns to appreciate their bearing on the agricultural problems of the district, at the same time learning the value of that accuracy and honesty of purpose which is vital to proper work of investigation.

‘Such training is calculated to produce in the cadet that right attitude of mind which is the aim and end of training, and which, when ingrafted, results in the cadet having acquired such habits of thinking, reading, and observing that his education is life-long, and he becomes a progressive and useful member of the agricultural community. The nature of his training affords him opportunities for remaining closely in touch with the workers of the Botanic and Experiment Stations, and with the work and publications of these and kindred institutions, whereby a lifelong form of education may, and does result.

‘The length of time a cadet should remain under training is often determined by personal considerations, but, if possible, it should extend to two years.

‘It is desirable that the cadet should receive some small sum of money weekly; while this should be regarded rather as a subsistence allowance than wages, it has a useful effect in more than one direction; it is extremely useful in that it familiarises the youth with the handling of small sums of money for his personal use, whereby he learns something of the value and limitations of money, and it also adds to his self-respect for there is no doubt that every right-minded lad feels justifiable pride in his first earnings. Besides, the

granting or the withholding of small increments affords his tutor some tangible means of expressing approbation or disapproval as circumstances may demand.

'A very useful purpose may be served by arranging that the cadetships of any particular place may be regarded in the light of scholarships awarded by the secondary schools of the districts. It is important to maintain the intimate association between the schools and the cadetship, and to insist on the continuity of the training; a system of cadet scholarships tends to insure this.

'The effort has been made in some institutions, with a certain degree of success, to afford opportunities for more extended practical training to some of the cadets by filling certain minor posts in the institution by means of cadets, who are allowed to hold these posts for limited periods only, and who, at the expiration of a specified time, are required to vacate them in order to make room for others. Occasionally a vacancy may occur on the permanent staff, to which a cadet may be promoted.

The training of youths in local institutions like the Botanic and Agricultural Experiment Stations is of value to parents, in that the expense of the training is likely to be quite moderate and within their means, as frequently the cadet can live with his parents or relatives; it is also of advantage to employers, for the work and progress of the cadets may be kept under observation, and promising youths may be chosen to fill vacancies that arise locally.

'In all of this there is little doubt as to the kind of youth to be trained or the nature of the work for which he is being trained. The cadet is taken to be a youth who has a good grammar school or secondary school training, which includes some Science subjects such as Biology, Chemistry, and Physics, which subjects he continues to study, if possible in his old classes, for a year or so during his cadetship: he is being trained in order that he may take up work on an estate or plantation in a position of minor responsibility, with the intention of rising to positions of increased responsibility, and ultimately of complete management or control as time and circumstance permit.

'It is to be observed that the systems of education so far described are in successful operation in various West Indian colonies. In some instance it may be suggested that the work is proceeding so unostentatiously and quietly that the authorities are hardly aware that they are in possession of fairly complete, and perhaps,

moderately adequate systems of agricultural education, which would be of still more service to the colonies if they received greater official recognition. It is abundantly clear to thoughtful minds that the quiet work of the Departments of Agriculture in advocating, and in some cases providing agricultural education in the West Indies, has already had a far-reaching effect that will be felt for some time, and this perhaps to an extent not generally recognized.'

The system thus described is in active operation in several colonies, and has already been productive of good results. As stated, it is usually worked through the medium of a form of Government scholarships held by pupils from the Grammar Schools, the pupils receiving the small monetary payments, regarded as part of the means of training as mentioned above. It is to be remarked, however, and this is a matter for regret, that few parents of pupils seem to recognize that training of this nature is available to their sons independently of the Government scholarships, and that it is open to them to make arrangements for their training at institutions readily available to them. When this becomes recognized, it is probable that the Governments of the several colonies will be required by the pressure of public opinion to make larger and more adequate provision for this form of training, for it can be made extremely efficient, while it is remarkably economical in its cost. We have here a valuable asset only partially developed, and one which with moderate effort can be made, at any rate for the time being, to afford at least much of the technical training which there are demands for Agricultural Colleges to furnish. The facilities thus already at the disposal of most of the colonies will pave the way for these colleges, and, even with their advent, the Botanic and Experiment Stations will continue usefully to be employed as training grounds, and will still remain available to the many who may not be able to go further afield to these colleges. It may be suggested that here there is an opportunity somewhat wasted.

In order to make provision for directing and encouraging the study of youths who have already left school, and are engaged in practical agricultural work, the Imperial Department of Agriculture instituted in 1908, and still continues, a series of Reading Courses and Examinations in practical agriculture.

For interesting particulars with respect to these examinations, reference can be made to the accounts of them to be found in the several Volumes of this Journal, from 1908 to the present.

PROPOSED SETTLEMENT SCHEME FOR EAST INDIANS.

In the issue of this Journal for October 20, p. 332, a brief note appeared in reference to a scheme of assisted colonization for East Indians in British Guiana, Trinidad, Jamaica, and Fiji, recently drawn up by the Inter-Departmental Conference to replace the indentured system of immigration which is being abolished in response to the strong objections entertained by educated Indian opinion. Before referring at greater length to the proposed new scheme, the details of which appear in *The Times* of September 1, 1917, it might be desirable to record what seems to be generally recognized as a fact, that under the abolished indentured system, the indentured East Indians who have become free settlers, suffer no political or social disabilities. On the contrary, the free Indian communities are admitted to have attained a high degree of prosperity; they take their place in the life of the colony on the same terms as other inhabitants. There are in some of the colonies many East Indians of independent means; some occupying positions of trust and honour in the Government service, a few in the professions, law and medicine; many are well-to-do merchants, while others still retain their relation to the soil, being either cane farmers or landed proprietors. It is evident, therefore, that the abolition of the indentured system of immigration is not due to any disability suffered by the immigrants in the endeavour to better their condition.

To summarize briefly the more salient proposals contained in this new scheme: their broad general aim, as stated in *The Times*, is to encourage the settlement of East Indians, after a probationary period of employment in the colonies, to train and fit them for the new conditions of life there, and at the same time to afford a supply of labour essential to the well-being of the colonies themselves. To this end the scheme seeks to encourage the emigration of permanent settlers. The immigrant will be entirely free of any financial liability connected with the cost of his introduction into the colony. The outlay incurred is to be met not by individual employers, but by the Government of each colony concerned, out of a common fund raised by rateable contributions from the employers either (1) of all Indian immigrants other than those locally born, or (2) of an immigrant during the first three years of his residence, or (3) during the period laid down as necessary to qualify him for a free return passage.

On first arrival the immigrant will undertake work for a 'probationary' period of six months under selected employers, the object being to enable him to learn colonial ways of life and work, and colonial methods of agriculture. He will then be perfectly free to move from one employer to another at a month's notice, being encouraged for the ensuing two and a half years in agricultural industries by the offer of numerous and important benefits subsequently as a colonist. At no time will he be under any indenture or contract, and the relation between him and his employer will be purely that prevailing in the colony between any master and servant; hence he will only be liable to be proceeded against for any breach of engagement by way of a civil suit in the ordinary course of law, and will not be liable to criminal penalties.

As to terms of employment, in the interest of the immigrant it is insisted that the Colonial Government should have power to decide who may and who may not employ him. To that end provision is made for the keeping of a register of approved employers by the Protector of Immigrants, and for prosecutions being brought against any person not entered thereon, who employs an East Indian during the first three years of his residence. A fair minimum wage will be

fixed, and be revised every five years on the basis of changes in the cost of living. During the first twelve months children under eleven years of age will be entitled to free rations on a scale to be determined by the Government; while children under five will be given free milk rations during the whole time their parents are at work for an employer on the register.

The granting of free garden plots of from $\frac{1}{10}$ to $\frac{1}{2}$ acre to each immigrant engaged in agriculture after he has completed his first six months of service is also provided for. In addition, steps are to be taken by the Government to make land available in the simplest and cheapest manner that can be devised for all immigrants who desire it, and who have completed three years' employment. Land not exceeding 5 acres in extent will be granted to an immigrant after three years' employment. The rent will vary according to the fertility and position of the land, and will be subject to revision every thirty years. For ten years after the grant the tenant will be prohibited from alienating or encumbering his right in the land, except with the sanction of the department of the colony by whom the arrangements will be carried out, and the department will have power further to resume possession of any land not brought under cultivation within two years of the grant.

This land settlement scheme is coupled with terms of repatriation to provide liberally for any immigrant who, for any reason, wishes to go back to India and not to take advantage of the facilities for settlement. He will be granted for himself and his dependents half the passage money after three years', three-quarters after five years', and the whole after seven years' continuous residence in the colony. Should an immigrant, who has had a free or assisted return passage, return to the colony, he will have no right to a second repatriation, wholly or partly, at the cost of the colony. The Protector of Immigrants may grant free return passages in full, in cases where he deems repatriation desirable, even in the case of settlers who have been reduced subsequently to indigent circumstances.

The emigration of whole families will be encouraged, and particularly of families containing young, unmarried girls who may become in the colonies the wives of other immigrants. Women, however, unaccompanied by their families will not be assisted. The proposals as to marriage registration are claimed to be an improvement on the present law: they provide immigrants with an easy method of legalizing marriages performed according to their own customs.

It is quite apparent from the foregoing brief summary of details, that this proposed new scheme is avowedly one of colonization, its fundamental purpose being the establishment of East Indians as permanent settlers in the colonies concerned. From the East Indian immigrant's standpoint the new arrangement would appear to be quite admirable, for he will be entirely free of any financial liability connected with the cost of his introduction into the colony. From the planter's point of view, however—and here allusion is made more particularly to those planters who have heretofore been concerned with operations under the old indentured system—it is obvious that the cost of East Indian labour will be greatly increased; the increased burden however, not necessarily falling on the shoulder of the individual planter only, inasmuch as the outlay incurred is proposed to be met, not by individual planters, but by the Government of each colony concerned, out of a common fund, raised by rateable contributions as detailed in the scheme and outlined above. There are other important considerations, too, which may evoke opposition to the scheme from those who have been concerned in the employment of labour under the indentured system of immigration. For instance, the essential necessity of

immigrant labour in the past has been for the maintenance of the chief industries of the colonies, whereas the proposed system which is to take the place of indentured immigration, would seem to relegate the requirements of the main industries with respect to labour to a secondary position, and to afford the planter no sufficient guarantee that the labour for which he pays will be continuously at his disposal. The immigrant will be virtually at liberty after the expiration of his six months' probationary period to move about where he likes, and to take his labour to any other registered employer. These and other points which may be urged against the scheme are entitled to careful consideration. Having regard, however, to the object with which the scheme has been brought forward, there is no reason for supposing that such considerations, important as they are, present insurmountable difficulties in the way of such modifications as may be found necessary to render the scheme acceptable to the Governments and colonies concerned, for the attainment of the end in question.

The advantages to be derived by the colonies mentioned from the system of colonization foreshadowed in the scheme from the view-point of further development, are beyond all question. Consequently it will not be too much to require that such colonies should bear a fair proportion of the cost of introduction. While it is true that in the past East Indian labour has been associated in the public mind almost wholly with the maintenance of sugar cultivation, it is a fact that other trades and industries have profited by the presence of time-expired immigrants. Granted that the objections indicated above are surmountable, and that the cost of introduction is brought within the available resources of the colony, the possibility of an extension of the scheme to certain of the smaller colonies in the West Indies might usefully be considered. There are in some of these smaller islands—Dominica for example—extensive areas of forest land which could be brought under economic cultivation given the necessary labour supply, but which remain unproductive and unremunerative owing to smallness of population and insufficient labour. The paucity of labourers here, as in other colonies too, has long been felt, and is a potent factor that has stood in the way of the possible introduction of new industries, and further and fuller development of existing industrial pursuits. Under such a scheme as is outlined above, with the modifications requisite to bring it within the power of such colonies to avail themselves of the advantages to be derived therefrom, their future development would only be a question of time. The present generation could not expect to reap direct advantage, but the benefits would accrue gradually, and only be fully realized and enjoyed by the future inhabitants. The scheme evidently is one that should receive the attention of the West Indian colonies as a whole, and particularly those whose future development would appear to depend more or less on the employment of imported labour, which might best be accomplished through a system of colonization so modified as to meet their requirements from the financial point of view.

AGRICULTURE IN BARBADOS.

November was a very trying month for crops of every kind. In some districts practically no rain has fallen since the third day of that month. The present drought began in the middle of October, so that the crops have experienced hard weather during two of the most critical months of their existence. We hope that December will be favourable; for a great deal depends on the rainfall from the present date until the end of January next year.

In spite of the dry weather, planters have continued the planting of their young cane crop. Some estates in the black soil have finished planting all their fields which were to be put under B. 6450. In the red soil a good deal of planting has also been done, but the planting season in this part of the island will be continued right on to the end of December.

In consequence of the unfavourable weather which has prevailed, planters are anticipating a low percentage of germination. In the most favoured districts we learn that the percentage will hardly exceed 65. As we have passed fields in the drier districts of the island, we have observed comparatively few holes growing as yet.

This does not, however, mean that the plants are dead. At least five weeks from the date of planting must elapse before it can be known what the result will be. Of this we are assured, that thorough tillage, proper manuring, and the general condition of the soil will play an important part at this juncture.

As was to be expected, the old cane crop has met with a check in its development. There is still some moisture in the fields but this has not been sufficient to hinder the canes from feeding on themselves. In the case of the low fields, a stunt may have been created which will permanently affect them. In any case the prospect of a shortage next year is much more apparent than at the date of our last report. Experience has shown that length of cane is not a guarantee of a good average return, unless a sufficient supply of food has been obtained from the soil during each month of the life of the cane. A shortage in the boiling-house or factory is always the result of a spell of dry weather even after the canes have apparently passed the worst. There is not only a smaller amount of juice but what there is is lacking in purity. No fields have yet turned brown, but the borders of some fields would give the impression that we had already reached the closing days of February or the early days of March.

There are a few wind-mills in almost every parish engaged in making early syrup. This is being manufactured principally from the canes of peasants who have sold plants.

In view of the high price of sugar in the local market at the present time, the supply of even a moderate quantity of syrup will be helpful.

Potatoes are as plentiful as at the date of our last report, while eddoes and yams are more easily obtained by housekeepers.

Both eddoes and yams are being sold at 3c. per lb., while potatoes remain at 3s. per 100 lb. Green peas may be purchased at 4c. per pint, but this price cannot long be maintained, as the trees give promise of a satisfactory crop. (*Agricultural Reporter*, December 1, 1917.)

It is not known whether the peanut, which is probably a native of Brazil, was used by the aborigines as a source of oil, but certainly, in a comparatively short time after the early explorers carried this product of the Western World back to Europe, its value as an oil material was recognized. Peanut oil, or arachis oil as it is usually known abroad, may be expressed from any of the many varieties of peanuts. That this oil is one of the most important of the world's food oils, is shown by the fact that over 120,000 metric tons of peanuts in the shell, together with about 240,000 metric tons of shelled nuts, are annually crushed in Marseilles alone, yielding 15,500,000 gallons of edible oil. The press cake left as a residue after crushing makes a highly desirable cattle feed. (*The Yearbook of the United States Department of Agriculture*, 1916.)

COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ending November 3, 1917, is as follows:—

ISLANDS. There was an active demand this week, taking all offerings, resulting in sales of 494 bales, the buying being on account of the Northern Mills, and the market closed very firm, with an advance of 1c. being paid to secure such offerings as the Factors were willing to sell. This advance was caused by the active and advancing market in Savannah.

We quote, viz:—

Fine to Fully Fine 72c. to 73c. = 74c. to 75c. c.i.f.

GEORGIAS AND FLORIDAS. The market opened quiet, but very firmly held, but towards the middle of the week there sprung up a very active demand from one buyer, taking all the offerings which Factors had authority to sell, and such lots as exporters and interior buyers were willing to dispose of on a basis of quotations. Consequently the market closed very firm, being swept of all offerings. We are unable to say whether this buying was to fill orders from mills or on speculation account. Some of the purchases were made on a basis of average Extra Choice, and others were on a basis of Extra Choice to Fancy at the following quotations:—

Extra Choice to Fancy 73c. = 75c. c.i.f.

Average Extra Choice 73c. = 75c. „

The exports from Savannah for the week were, to Northern Mills 277 bales, Southern Mills 51 bales, and from Jacksonville to Northern Mills 735 bales.

BRITISH COTTON GROWING ASSOCIATION:

The one hundred and sixty-fifth meeting of the Council of the British Cotton Growing Association was held at the Offices, 15 Cross Street, Manchester, on Tuesday the 6th ultimo. In the absence of the President (The Rt. Hon. the Earl of Derby, K.G.) Mr. J. Arthur Hutton occupied the Chair.

WEST AFRICA. During the past month, the Association have had advice of the shipment of several hundred tons of cotton seed from Nigeria, and it is hoped that the bulk of the seed which they have in stock in West Africa will be shipped before the new season's cotton crop begins to come in.

The purchases of cotton in Lagos to October 31, amount to 7,768 bales, as compared with 9,257 bales for the same period of last year, and 6,050 bales for 1915. The purchases in Northern Nigeria to September 30 amounted to 3,795 bales, as compared with 10,510 bales for the same period of 1916, and 603 bales for 1915.

A very interesting report has been received from one of the Association's agents, dealing with his tour through the Sokoto Province of Northern Nigeria; the report is most promising and proves that there is plenty of room in Northern Nigeria for further expansion, and that previous reports as to the possibilities in Northern Nigeria have by no means been exaggerated.

NYASALAND. The difficulties in shipping from Nyasaland have been considerable, and the Association have still about 500 bales of cotton unshipped from last year's purchases. It is hoped that the bulk of this cotton will be shipped at an early date, as the Ministry of Shipping have arranged for a special allocation of 500 tons of space to be reserved for the monthly shipment of Nyasaland produce from Beira or Durban when the tonnage is in actual excess of the priority cargo arranged for each given month.

UGANDA. It was mentioned that a large quantity of last year's Uganda cotton crop had recently been received in Liverpool, and that the cotton was of very good quality, and would be extremely useful to Lancashire Spinners in view of the present shortage of long stapled cotton.

It was mentioned that the Association had approached the Board of Trade calling attention to the fact that owing to the difficulty of covering purchases of cotton in 'Futures' and the serious shipping outlook, it might be impossible to buy next season's cotton crop in Africa, and proposing that the Government should either help the Association to buy the cotton, or take it over themselves in Africa, as it would be a most serious matter if the natives were unable to find a market for their crop. No definite reply has yet been received, but it is hoped that the Government will take the matter in hand.

EGYPT AND THE SUDAN. Some important information has recently been received with regard to the possibilities of increasing the production of cotton in Egypt and the Sudan.

In Egypt the drainage and irrigation schemes should in course of time add another 800,000 bales of 500 lb. each to the Egyptian cotton crop, and in the Sudan the dam and canalisation schemes should produce, within a period of, say, twenty-five years, something like 440,000 bales of 500 lb. each. It is extremely satisfactory to know that there is every reason to anticipate an increase of about 1½ million bales from Egypt and the Sudan, with possibilities in the future of a further increase, if large storage works are constructed on the upper waters of the Blue Nile.

With regard to the scheme for irrigating the Gezira Plain, a telegram was read from the Board of Trade, stating that Sir Albert Stanley is hopeful of arranging with the Treasury for an advance, to enable the preliminary works in connexion with the scheme to be proceeded with.

DESIRABLE FRUIT TREES.

The West Indian islands are the home of exotic plants. Almost every economic agricultural product from these islands is derived from trees or plants introduced into them from the eastern or western continents since their discovery by Columbus. In the early days of their colonization, paternal governments or individual enthusiasts introduced into these islands plants which have since become of the greatest importance, such as the sugar-cane, the coco-nut, the lime, and the cacao tree, not to mention such other trees as the breadfruit, the mango, the orange, or the tamarind. West Indians of the present day can hardly picture these islands without the plants mentioned above, and yet they are but a few of the exotics which have flourished, and now enter into the everyday life of the West Indies.

In more recent years there has occurred the successful acclimatization in Grenada of the nutmeg tree, the cultivation of which seems to have enabled that island to enter upon a new life after the decay of the sugar industry there, and before the successful development of the cacao cultivation. In many of the islands, however, especially the drier ones, there does not seem to be any importation of new plants specially suited to their conditions, though wonderful

improvements have taken place in the cultivation of crops long established.

The Government of the United States, especially since the acquisition of tropical territories—Hawaii, the Philippines, and Porto Rico—has devoted much money and much enterprise in seeking for new plants which might advantageously be introduced into the tropical regions under its sway. The Bureau of Plant Industry of the United States Department of Agriculture issues from time to time an inventory of seeds and plants imported by the Department, which sends its agents all over the world in search of new plants or new varieties, which may be of use in any region of the territories of the States. These inventories are not merely plant catalogues, but are full of interesting notes on the plants catalogued. The one last received at the Head Office of this Department contains the list of plants or seeds imported from No. 37647 to No. 38665. Some of the notes refer to plants that would seem admirably adapted to West Indian conditions.

To begin with *Zizyphus jujuba*, the jujube tree, in one of its varieties already semi-naturalized in Barbados, and also sparsely grown in Antigua, under the ugly name of 'dunk', possibly derived from the foetid odour of its flowers, is found to have been subjected in Southern China to cultivation and selection from very ancient times. The inventory mentioned above gives particulars of dozens of varieties, ranging in size from that of a small cherry to that of a hen's egg, and in quality from not edible to being a rival of the date. It might be well worth while for drier islands, like Antigua or Barbados, with their scanty supply of the more luscious tropical fruits, to introduce some of the finer varieties of *Zizyphus*, which might be advantageously grafted upon the already naturalized poor kind.

Another species of this genus described is from Brazil. There it is known as 'jua' (*Zizyphus Joazeiro*). The following note, by Messrs. Dorsett and Popenoe, seems to show that it might well be utilized on pastures in such islands as Antigua, Barbados, or the Virgin Islands. On account of its value as a forage tree, it might prove very useful in times of drought. Too little use is made of such forage trees in the smaller and drier West Indian islands. The description of the tree is as follows:—

'This interesting and valuable tree is common on the dry lands bordering on the Rio Sao Francisco from Joazeiro nearly up to the border of the State of Minas Geraes. At Joazeiro it is quite common, but the trees are usually found scattered among the other plants, and do not occur in large groves. In places where cattle and horses can get at the trees while young they are kept eaten off almost to the ground, and have a peculiar dwarfed, stunted appearance. When allowed to develop to mature size the tree forms a beautiful dense green, umbrageous head of foliage, 30 feet in diameter. The leaves are somewhat hard and brittle in texture, oval to ovate, about 2 inches in length. The small wood is armed with short, stiff thorns, which are not, however, particularly dangerous. The fruit varies greatly in size according to the tree by which it is produced. The best fruits are nearly an inch in diameter, creamy yellow in colour, spherical or nearly so. Inside the thin skin is a thick layer of mealy flesh, within which lies the seed and the layer of translucent, mucilaginous pulp which surrounds it. The seed is about the size and shape of a small olive stone. The pulp adheres to it very closely and can scarcely be separated even in the mouth. The flavour is peculiar and somewhat insipid. The trees bear prodigiously, the ground under them being covered with fruits at the end of the season. Sheep, cattle, horses, and swine eat the fruit greedily, and it is considered wholesome for them. The principal value of this tree would seem to be as a source of stock feed in dry regions, both

the fruits and the foliage being of value for this purpose. In addition, the ornamental value of the tree and its drought-resisting qualities commend it for culture in arid regions.'

All West Indians know the several species of *Spondias* which are among our commonest fruits—golden apple, Jamaica plum, hog plum, and other varieties. In the inventory already referred to is a description of another variety which seems worth a trial in these islands, accustomed as the West Indians are to the somewhat peculiar flavour of the fruit of this genus. In Brazil it is known as 'imbri', and the botanists have named it *Spondias tuberosa*. According to Mr. Dorsett: 'The tree, which is wild and quite common in some places, is of a peculiar habit of growth, branching 4 to 6 feet above the ground and forming a very broad, dense, and flat-topped head of foliage. When the large limbs are cut and placed in the ground as fence posts, they take root and grow. The fruits, which are sometimes produced in great profusion and are ripe at this season, are oval in form, about 1½ inches in length, and light green in colour. The skin is rather tough, and incloses the translucent, juicy pulp in which is embedded the single large seed. The flavour of the pulp is rather suggestive of a sweet orange, and is agreeable in the extreme. Aside from being consumed in the fresh state, the fruit is extensively used for the manufacture of jellies and jams, in which a considerable trade has been built up. In addition, a popular desert called *imbuzada* is made from the slightly unripe fruit by mixing the strained and sweetened fruit with milk.'

MAIZE PRODUCTS.

The world's crop of maize exceeds that of any other one cereal or grain under cultivation, oats, wheat, rice, rye, barley following in the order named. To growers of maize in the West Indies only two parts are considered of value: the grain of course as a source of food for man and beast, and the whole plant as a forage crop.

But the Americans utilize every part of the plant which is really more precious to them than the bamboo to the Japanese, or the coco-nut palm to the Pacific Islanders.

To begin with, the cob is ground up and mixed with the crushed grain as a valuable foodstuff for animals. Besides this, the cob possesses great manurial value. It is calculated that a ton of corn cobs yields 500 lb of potash, along with other valuable fertilizing agents.

The pith of the stalks is converted into cellulose, which is utilized in the manufacture of smokeless powder and other explosives, and has been in vast demand during the present war.

The pith also supplies material used as an insulator in refrigerating chambers, electric dry batteries, and other similar constructions.

Out of the spathes, or husks covering the cob, various articles, such as straw mats and hats are manufactured, and a specially tough parchment paper.

Starch is largely produced from the grain, and large quantities of glucose syrup are also made from it, which is known in America as 'Golden Syrup'. Alcohol is also distilled from the grain.

From the germs of the grain a bland oil is extracted, which is wholesome and palatable, and is used as a substitute for olive oil in cookery.

The aboriginal North Americans regarded maize as the special gift of the Great Spirit to their tribes and it afforded them their chief and almost sole supply of vegetable food. But the modern North Americans have so utilized this plant in the ways referred to above, as to render it of inestimable value to the human race throughout the world.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this issue is a continuation of the series of articles in reference to education. It deals with the question of technical education in agriculture of pupils from secondary schools.

On page 388 will be found an article on the proposed settlement scheme for East Indians in other parts of the Empire.

The melon fly in Hawaii is the subject of Insect Notes on page 394.

On page 398 will be found an article on dasheens, tannias, and eddoes, and their uses.

Agricultural Colleges for the Tropics.

In the debate on the Colonial Office vote in the House of Commons, commented on in *Tropical Life*, September 1917, Lord Henry Bentinck is reported to have said: 'I would put to my Right Honourable friend the Colonial Secretary, the necessity of the Royal Commission's enquiry into whether the capacity of our dependencies to produce could not be enormously increased by further provision for research. I do not for a moment deny that very good work is being done both in East Africa and West Africa, and also in the West Indies, by their Agricultural Departments, but it would be of enormous benefit to our Colonial Empire if we were to spend more money on research. We want two agricultural colleges—one in the West and one in the East—first of all for the stimulation of research; secondly to train young men to go out to our Crown Colonies and to settle down as producers themselves; and thirdly to train a staff of young men who could act as agricultural instructors, and educate the natives. I do most strongly urge that research is the basis of all progress in agriculture. . . . If we are going to develop our resources properly, the first thing we should do is to spend money upon research. I have already given proof of the wonderful increase of production that has been brought about in India by this means, and I suggest that a similar increase could be brought about in Africa and the West Indies by the same means.'

With reference to the above speech, there appears in the same number of *Tropical Life* a very excellent cartoon which sums up the situation very fairly.

Cotton Production in California.

Every season of scarcity and high prices brings renewed enquiries regarding the possibility of extending the production of cotton into new regions. The industrial uses of cotton are being increased more rapidly than facilities of production. There is the need of developing larger and more regular supplies, especially of the better classes of cotton fibre. Accordingly *Bulletin 533* of the United States Department of Agriculture deals with the possibility of the development of cotton production in California, and comes to the conclusion that the present possibilities of cotton culture in that State lie in the direction of producing Egyptian or other special types of long stapled cotton. The writer, O. F. Cook, of the Bureau of Plant Industry, thinks that the wider introduction of cotton growing into California is but a question of time, and that in many respects it will serve to improve the agricultural prosperity of the State. The demand for cotton of the Egyptian type is increasing rapidly, and is not likely to be met by large increased production in Egypt. Mr. Cook warns farmers, however, that although favourable natural conditions may exist, it is not advisable to grow cotton on a commercial scale except to such an extent as to warrant the erection of ginning establishments and oil mills. A further warning is given against the importation of cotton seed either from the

Southern States or from Egypt, and we would add, or from Brazil also, in order to prevent the introduction of the boll weevil or the pink boll worm.

Fixation of the Nitrogen of the Air.

An article in *Nature*, August 30, 1917, on the progress of applied chemistry, draws attention to the fact that perhaps no development of chemistry promises greater consequences to mankind than the fixation of the nitrogen of the air. The rival methods at the present time are the direct method of oxidation of the nitrogen to nitric acid, and the production of ammonia by the combination of nitrogen and hydrogen. Various means of bringing about the first result are employed, and it is contended that the Kilburn Scott furnace increases the efficiency of the process by bringing the whole of the included air under the action of the electric spark. With respect to the second result, the synthesis of ammonia, the latest refinements of chemistry and physics are of enormous importance in the very complicated process. The actual combination of the nitrogen and the hydrogen is brought about by catalysts consisting of various metals or combination of metals. The activities of the chemist in producing cheap fixed nitrogen will have a profound influence on the manurial problems of agriculture.

Progressive Desiccation in South Africa.

In reviewing a paper on this subject, the reviewer in the *Geographical Journal*, October 1917, is not quite convinced that there is positive evidence of any diminution of rainfall in South Africa during the last two or three hundred years. Whether or not this is the case, it is asserted that the progressive desiccation of the country is evident. Possibly this has been effected through a change in the character of the rainfall from soft soaking rain to violent thunderstorms and cloud bursts, which may be traceable, in the first place, to the extensive felling of forests and burning of grass land. Such clearings facilitate the rapid run off of water which would otherwise percolate slowly into the soil. This rapid run off of water brings about desiccation and consequent heating of the soil. Such tracts of bare heated land are unfavourable to a well distributed rainfall, the influence being explained as follows: 'If a current of air laden with moisture meets a land surface, the question whether or not the moisture shall be precipitated depends on the temperature of the land surface. If this is cooler than the vapour-laden air, it causes the density of the air to increase, the air becomes saturated, and precipitation takes place. If, on the other hand, the temperature of the ground is higher than that of the air, it causes the air to expand, rise, and carry off the moisture it brought.' It is quite likely that some such effect as this does take place, and that, *ceteris paribus*, forest-covered country tends to provoke a more uniform condensation than bare country; but the question of the relation between forests and rainfall, although discussed over and over again, cannot be said to be definitely settled yet.

Food Conservation.

The suitability of vegetable oils—coco-nut, cotton and ground nut—for human consumption as substitutes for butter and lard has often been pointed out. With reference to the present shortage of the butter supply in Great Britain which is reacting on the milk supply, so that a shortage of the latter is to be feared—a veritable disaster to infants and invalids—Mr. Hamel Smith, the editor of *Tropical Life*, suggests a remedy. In a letter on this subject dated October, 15, 1917, which was published in the *Financier*, Mr. Smith suggests that it is advisable (1) to prohibit the manufacture of butter from cow's milk for the present in Great Britain, and (2) to encourage, perhaps to insist on, the extraction of all vegetable oils, when practicable, at the centres of production, thereby reducing the space needed for shipment of the copra and oil seeds in bulk to Europe. This would have the excellent result of leaving behind on the estates where such crops are produced the coco-nut or oil-cake as a valuable food for cattle, pigs, and poultry. Such a course ought in turn to enable many more cattle and pigs to be raised profitably in tropical countries, and to allow of the carcasses being exported at a cost low enough perhaps to be able to compete in British markets with those from South America. Mr. Smith believes that in times to come the tropical, rather than the temperate zone, will produce the greatest number of pigs, if only on account of the 'mountains' of poonac, that is to say, the meal left after extracting the oil from the copra which it does not pay to ship elsewhere for feeding animals on.

Fresh Fruits and Vegetables as Substitutes for Meat and Bread.

Farmer's Bulletin 871, of the United States Department of Agriculture, contains many recipes whereby fresh fruits and vegetables may profitably be employed to take the place of other staple foods. It points out that the principal food substances needed in human diet are starch, sugar, vegetable acids and fibre, fat, protein, mineral substances, (such as iron, calcium, phosphorus and others), and also certain substances necessary for growth and health, which have only recently been discovered, and to which the names vitamins and hormones have been applied.

The bulletin points out that peas, beans, and similar legumes are most useful in reducing the quantity of meat required in a well balanced ration; that sweet potatoes and similar vegetables are wholesome substitutes for bread, while all fruits and greens, and succulent vegetables supply the diet with mineral substances and the vitamins essential to health which are present in them. If used intelligently, such a diet consisting chiefly of vegetables, will not lack starch or protein. In connexion with these foods, however, it is highly desirable to use skim milk, which like fresh fruits and vegetables, is perishable and can only be profitably used within a short period after its production.



INSECT NOTES.

THE MELON FLY IN HAWAII.

From time to time within recent years articles have appeared in this column of the *Agricultural News* dealing with fruit flies. Some of these articles were devoted entirely to the Mediterranean fruit fly, as being perhaps the most important of this group of pests. Another member of this group, however, has been attracting considerable attention in various parts of the world, mainly in the East. The insect in question is the melon fly (*Bactrocera cucurbitae*, Coq.), which has been recorded from India, Ceylon, Java, Timor, Northern Australia, Singapore, the Philippine Islands, Southern China, Japan, and the Hawaiian Islands. It is in the last named country that the melon fly has assumed the greatest importance, and a brief account of this insect, as it occurs in Hawaii, is taken from *Bulletin 491* of the United States Department of Agriculture by E. A. Back and C. E. Pemberton, who have done much valuable work in fruit fly investigations in Hawaii.

It is now considered by Bezzi and other entomologists that the melon fly had its native home in India. Its spread to other widely separated countries has been due, not to natural agencies, but to the assistance of man.

Its introduction into the Hawaiian Islands took place about 1895, and when discovered in 1897 it was already a serious pest. The favourable climate and abundant food supply prevailing in Hawaii have enabled the melon fly to increase to such an extent that at the present time the free cultivation of many of the crops grown by market gardeners has been rendered impossible. This pest not only attacks such cucurbitaceous crops as squashes, pumpkins, vegetable marrows, melons, cucumbers, etc., but it is also destructive to tomatoes, cowpeas, and string beans. The annual loss due to the melon fly in Hawaii is estimated at \$750,000.

LIFE-CYCLE.

Under favourable warm weather conditions in Hawaii, the egg, larval, and pupal stages may occupy as few as twelve days, or as many as twenty-eight and a half days. At lower temperatures the duration of the immature stages may be greatly lengthened and occupy as much as three and a half to four months. It has been found that the adult flies can be kept alive for a period of 431 days, although adults deprived of food and water never live more than 102 hours, or more than 120 hours without food but with water.

The complete life-cycle may, therefore, take from 443 to 459 days under favourable conditions of food and climate, but will take longer under less favourable conditions.

Under natural conditions the adult flies live chiefly on the honeydew secreted by such insects as aphids, leaf hoppers, and scale insects, upon the juices of host plants, and the nectar of flowers. The flies are rapid fliers, but apparently do not indulge in long-sustained flights. In captivity, mating does not begin until about twenty days after emergence, and egg-laying under these conditions first takes place in about another twelve days. It was found by Messrs. Back and Pemberton that when fed on cucumber in captivity, mating will begin when the adults are only ten days old, and egg-laying

will take place the next day. This is when the temperature and humidity conditions are favourable. After egg-laying has begun the adults continue to deposit eggs every few days throughout life, and it has been estimated that a vigorous and long-lived fly would be capable of laying as many as 1,000 eggs during the year or more of her existence.

The eggs are laid within the tissues of the host plant or fruit by means of a sharp ovipositor. No portion of the plant is free from attack, since the eggs may be deposited on almost all portions of the plant and fruit.

The larvae on hatching usually bore their way to the centre of the plant or fruit, but the place of feeding is determined largely by the moisture content of the host. In the case of young seedlings the larvae may burrow into the tap root and kill the plant. In juicy plants which have made a good growth they bore through the leaf petioles and stalks, causing the death of the parts attacked. The young fruits of all cucurbitaceous crops are badly attacked and destroyed as a rule but the older fruits of some species are more resistant to attack. They are, however, usually deformed by the presence of numerous colonies of larvae in open surface wounds.

After passing through three instars the larvae leave the host and pupate in the soil, usually beneath the host. The larvae after leaving the fruit are able to jump a few inches, in stages, and can thus find more suitable places to pupate, and if they cannot enter the soil they will pupate on any hard surface.

There are as many as eight to ten generations of the melon fly a year in Hawaii, so that the pest is able to multiply very rapidly. The melon fly is spread largely in the larval stage, being carried in fruits from one country to another, and it is constantly being intercepted at the Californian ports in ships arriving from Hawaii. The local spread from one town to another may occur in the adult or in the pupal stage.

CONTROL MEASURES.

Under Hawaiian conditions there are at present no natural agencies, such as parasitic and predaceous enemies, that can check the abundance of the melon flies. Further, no satisfactory artificial means of control have been successful in controlling this pest under Hawaiian conditions. The writers consider that these methods are not likely to be successful so long as the cultivation of the chief host plants of the melon fly is carried on by uneducated orientals, who do not practice clean cultivation or co-operate in applying remedial measures.

J.C.H

A NEW METHOD OF KILLING WEEDS IN CANE FIELDS.

In the last issue of this Journal December 1, 1917, notice was drawn to a speech of the Hon. Charles Hedley Strutt on the subject of progress in tropical agriculture, in which was emphasized the vital importance for every manager of a tropical estate never to rest satisfied with the methods of agriculture which were thought satisfactory a few years ago, but always to be on the alert to experiment with and adopt new methods and new appliances, in order not to be left behind in the race for success.

An article in the *International Sugar Journal*, October 1917, much of which is reproduced below, shows the alertness of mind, and the readiness to receive new ideas, with the determination to find out their value and employ them to the utmost when found useful, which the Hawaiian sugar planters are exhibiting in the conduct of their business. It

is a wonderful thing that a sugar plantation intends to erect a paper-making plant, not to utilize waste products, but to economize in its labour bill, and to increase the product of its canes.

With such a mental attitude among planters there is no wonder that the sugar industry in Hawaii is an example of efficiency to the sugar-cane world. The article referred to states under the heading above that:—

Within the past year a novel process of destroying weeds in cane fields has been devised and developed by Charles Eckart, Manager of the Olaa Sugar Company in the Hawaiian Islands, with the result that less than one-half of the labour formerly required is utilized on the treated areas in bringing the cane to maturity. In addition to this large saving in manual labour, the increased yield of cane is estimated at not less than 10 tons per acre on an average.

The process is based on the principle that small unexpanded cane shoots are able to penetrate a suitable paper covering placed on the rows of stubble immediately after harvesting, whereas weeds are unable to penetrate the covering.

The first step in this process is to free the rows of the trash, as soon after harvesting as possible. Any shoots which are in evidence in the cane row are cut off with the hoe. The ratoon rows are then fertilized, the fertilizer being distributed along the middle of the rows. Strips of tarred or asphalted felt paper (weighing not more than 9 lb. per 100 square feet) are next placed longitudinally on the rows of the ratoons so that they lie directly over them. If a fair number of stones are conveniently at hand, these are placed along the edges of the paper strips to hold them down, and in addition the edges of the strips are covered with some of the cane trash lying between the cane rows. It has been found that the trash is generally sufficient in itself to hold the paper in place against the tendency of the wind to lift them.

A mechanical device is employed for the laying of the papers, which performs the operation very rapidly and at small expense.

Owing to the spear-like and comparatively rigid nature of the young cane shoots, and the mechanical pressure they are able to exert when they come into contact with the paper covering, the latter is punctured, and the shoots emerge. The weeds, with their relatively soft terminal points, which spring up under the covering, are, on the other hand, unable to puncture the paper, and are soon smothered out, or in a blanched condition are dried up by the heat of the sun radiating from the underside of the covering material.

If the cane rows were smooth and regular, so that the paper could lie in perfect surface contact with them, a complete stand of cane would emerge through the covering strips. Small irregularities, however, due to stones, elevation of the old stools, or to unevenness of the land, allow many of the young shoots to expand or unfurl before they come into contact with the paper. Since these expanded shoots are neither spear-like nor rigid, most of them are unable to puncture the paper and come through but unlike the weeds they manifest surprising vitality, and by continued growth cause tent-like elevation of the paper covering.

After five or six weeks from the application of the paper coverings to the cane rows, labourers pass along the rows, and with a knife cut longitudinal slits in the paper at such places as are under pressure from expanded shoots, these places being distinctly shown by the tent-like elevations already referred to. This slitting is inexpensive, and only costs about 35c. an acre in practice. During the interval between the laying of the paper and the slitting operation the soil under the paper becomes bare of weeds; and such

weed seeds as would germinate under normal conditions sprout, and the resulting young weed plants die. On this account no weeds emerge through the slips, and those cane shoots, which have been imprisoned as it were, gradually come through, and complete the stand in the row. At first these shoots are naturally very pale, but they quickly turn green and take on a vigorous growth.

The large gain in the growth of the cane in this process is due to the automatic eradication of weeds in the cane rows, and to the mulching action of the paper covers. Such weeds as develop in the spaces between the cane rows can be easily controlled by light hoeing.

This process is now being conducted by the Olaa Sugar Company on a fairly large scale, and the Directors of the plantation are contemplating the erection of an auxiliary paper mill of sufficient size to meet the demand of the field for paper mulches. The raw material for the manufacture of the paper will in such event be a part of the megass from the crushed cane, so that the paper mulches will be turned out at a comparatively small cost.

It may be that this system can only efficiently be carried out where irrigation can be employed. But after careful reading, it would seem that even where the water-supply is dependent on the rainfall, the system might be a success, because of the uncovered lines between the rows of ratoons, which have to be weeded, and into which the rain would adequately penetrate, and also because of the evident toughness of the felt paper employed, which would require probably more than the five or six weeks of its use to render it too much sodden and tattered to serve its purpose. In any case the development of this method may well be watched for with interest.

DEPARTMENT NEWS.

From letters recently received at this Office we learn that Mr. W. R. Dunlop, Scientific Assistant on the Staff of the Imperial Department of Agriculture, has received his commission as Lieutenant in the R.N.V.R.

Mr. P. Taylor, Clerical Assistant, also on the Staff of the Department, is serving in the East Africa Expeditionary Force in the Army Ordinance Corps.

Mr. W. Nowell, D.I.C., Mycologist, and Dr. J. C. Hutson, B.A., Ph.D., Entomologist, on the Staff of the Imperial Department of Agriculture, returned to Barbados from St. Vincent, on December 10, 1917.

The United States Department of Agriculture has issued in *Service and Regulatory Announcement*, No. 21, the draft of a bill for the establishment, under State Laws, of Divisions of Marketing, which, with slight alterations to suit local conditions, might be utilized anywhere. The task was undertaken in response to repeated requests from various quarters, but the Department makes it very clear that it is not urging the measure upon any State. This proposed bill has as its object the subjecting to State regulation and control, as affecting public interests, the marketing of all farm products, which are defined as any product designed for food purposes.



GLEANINGS.

The cane crop forecast for the 1917-18 season in India, which is based on official reports covering about 95 per cent. of the total area under sugar-cane, shows that some 200,000 more acres in India are under cane than in the previous season, the total being 2,442,000 acres. (The *International Sugar Journal*, October 1917.)

According to the *Perfumery and Essential Oil Record*, October 1917, the producers in the West Indies of bay and lime oils ought to be satisfied with the prices obtainable for these products. Bay oil is quoted at from 12s. 6d. to 13s. per lb., while lime oil, distilled, fetches 8s. 6d. per lb., and hand pressed from 17s. 6d. to 18s. 6d.

Professor O. Beccari, in a paper contributed to the *Philippine Journal of Science*, January 1917, on the origin and dispersal of the coco-nut palm, concludes that an Asiatic origin of the palm is more probable than an American one, and that the palm may have been very easily disseminated by the agency of oceanic currents.

In the report of the Standing Committee on the Draught Mongoose Ordinance, printed in the *Proceedings of the Agricultural Society of Trinidad and Tobago*, October 1917, it is suggested that having regard to the fact that there are at present no mongooses in Tobago, steps be taken to prevent their introduction into that island. From the experience of other small West Indian islands a prohibitory Ordinance in this direction is most advisable.

The unsettled condition of the Chinese market, and the increase in the Formosan sugar production threaten the Philippine sugar industry with the loss of both its Chinese and Japanese markets. The *International Sugar Journal* for October 1917, states that efforts are being made to get the United States to take their accumulated stock. Freight rates are too high, however, to enable Philippine sugar to be sold at a profit in the States in competition with other sugars.

Many Zululand planters believe that cotton offers excellent prospects as a remunerative crop. The growing of cotton does appear to hold out remarkable prospects; it is said that £50 to £60 per acre is not too high a figure to place upon the average gross return at present prices. There is a possibility that a very big industry may be started in that country in the near future. If cotton could once be established, it would prove a great thing for all South Africa. (The *South African Sugar Journal*, August 15, 1917.)

It is interesting to note that a series of experiments as to the merits of planting sugar-cane on the flat compared with planting it in furrows, especially with the view of facilitating the introduction of mechanical cultivators, is being undertaken at Slob estate in the island of St. Croix. This estate is owned by the West Indian Sugar Factory Company, and the experiments are conducted by Mr. Edward Gedde. Only one year's results have been reported on; the outcome of several years' experiments will be looked for with interest.

Spineless varieties of prickly pear have often been considered as worthy of attention in dry countries as fodder plants. According however to the *Agricultural Gazette of New South Wales*, October 1917, after five years' experiments with twenty varieties of spineless *Opuntias*, the Director of the Botanic Gardens, Sydney, has come to the conclusion that, as a fodder plant the *Opuntias* cannot be recommended for any other reason except their ability to withstand prolonged drought. Their nutritive qualities he finds to be relatively small.

With reference to the damage done by the hurricane of September 23 in Jamaica, the *West India Committee Circular*, November 1, 1917, quotes as an instance mentioned in the *Jamaica Gleaner*, the destruction in Portland: 'It is safe to say that there is not a single house in this district that was not blown down which is not badly damaged. Thousands of coco-nuts, grape fruit, and oranges lie in heaps along the roads and fields. Not a single stem of banana is standing. The yam crop is gone along with bananas. Breadfruit is a thing of the past, hardly a tree left with a fruit on it.'

The *Board of Trade Journal*, October 18, 1917, states that the Acting Colonial Secretary at Kingston, Jamaica, writes, under date September 4, that a company has been formed in the colony, with shareholders there and in the United Kingdom, for the purpose of carrying on a dyewood factory. A site for the erection of the factory and water rights have been obtained, and as this property extends to the foreshore, facilities for landing and shipping have also been granted. The scheme is in abeyance at present, owing to the fact that machinery for the factory cannot be obtained.

Tractors and motor trucks have become in the last few months one of the most important items of equipment on the Hawaiian sugar plantations, until hardly a crop is harvested to-day without the aid of these two products of the gasoline age. In 1912 there were only three tractors in the island, and to-day the number runs well over 100. Motor trucks are almost as numerous on sugar plantations now as passenger automobiles. Ploughing, furrowing, cultivating, hauling cane carts or waggons, and a dozen other useful purposes are being found for the tractor on island plantations. (The *Louisiana Planter*, October 27, 1917.)

In the account of a very successful local agricultural exhibition held in the parish of St. James, Barbados, December 5, 1917, the *Agricultural Reporter* notices two new features which are deserving of commendation. First, prizes were given for agricultural work done on the spot by school boys. Twenty eight boys competed in digging cane holes, while twenty-four boys entered the competition for forking and bedding. The results are reported to have been most satisfactory. Second, the children of the elementary schools were offered prizes for the collection of insect pests attacking economic crops.



ST. VINCENT: REPORT ON THE AGRICULTURAL DEPARTMENT, 1916-17.

This report contains a record of work of diversified character, and in many respects of great and permanent value, showing that the officers of the Department in question not only take an interest in their work, but also throw much energy into its performance.

In the first place the care that is taken to preserve and improve the beautiful Botanic Garden is most commendable. This Garden is of historic interest. It is the oldest garden of its kind in the smaller British West Indian islands, having been established in the year 1765. Among other early introductions were some of the original breadfruit plants brought to the West Indies from the Pacific Islands by Captain Bligh in 1793.

Turning now to the economic side of the work of the Department, it is to be noticed that great attention is paid to questions relating to the cotton growing industry, and naturally, as it is the chief industry in the island. Unfortunately the year under report has been a very trying one to the cotton growers for two reasons: first, the unpropitious weather conditions, especially the unprecedented heavy rainfall in November 1916; and second, the very serious attacks of insect and fungus pests on the crop. Seeing that the type of Sea Island cotton produced in St. Vincent is of the highest quality, and commands therefore the highest prices, it would be a veritable disaster if this type could no longer be profitably cultivated. The work therefore of Mr. Sands, the Agricultural Superintendent, in carefully studying the life-history and habits of the cotton stainer bug, which is thought to be largely responsible for most of the trouble in the cotton fields of the island is one of great value. Acting on the information thus gained, the Government of St. Vincent, through the officers of the Agricultural Department, and with the co-operation of the cotton growers, have undertaken a vigorous effort to destroy the plants on which this pest feeds in the intervals between the cotton crops, with the hope of effective control of it. In connexion with the cotton crop also, the researches being carried out by Mr. Harland, the Assistant Agricultural Superintendent, in manurial experiments, and in cotton breeding are also of great interest and value. It is hoped that before long the efforts to combat the pests and to improve the quality of the cotton in St. Vincent will lead to beneficial results in both directions. To quote a remark on page 17 of the report, 'The weather cannot be controlled, but it is absolutely necessary to control the cotton stainer, if the stability of the valuable cotton industry is to be ensured.'

In connexion with the cotton industry, the successful working of the Government Ginnery in the 1916-17 crop, which is conducted on a co-operative basis, is to be noticed. After deducting the payment made on account, and all charges, three-fourths of the net profits made by the sale of lint and seed are returned to the grower.

The next most valuable industry in St. Vincent to cotton is that of starch, which is manufactured from arrowroot and cassava. The prices obtained for these starches during the season under review was remunerative, although the output was lessened by the heavy rains of November. The total amount exported of arrowroot starch in 1916 was 4,441,242 lb., valued at £37,619, and 182,004 lb. of cassava starch, valued at £860.

After an almost total cessation in the production of sugar the island has returned to the cultivation of sugar-cane during the past three years, on a somewhat large scale. The sugar and sugar products, in point of value, are now the third on the list of exports. While only 250 lb. of sugar, valued at £2, and 3,252 gallons of molasses and syrup, valued at £171, were exported in 1913, in 1916 there were exported 1,198,314 lb. of sugar and 33,771 gallons of molasses, of the total value of £10,995. The extension of sugar-cane cultivation seems only to be limited at present by the capacity of the small mills.

Another crop in which considerable progress has been made is that of Indian corn. This seems to have resulted from the following causes: the shortage of imported cereals, the remunerative price obtainable for the grain, the advisability of a locally produced supply of corn meal, and lastly, the facilities given by the Government granary for the purchase of corn on a co-operative basis, and the kiln drying and storage of it. From the interesting account of the working of this granary it appears that the total quantity of corn dealt with for the crop was 128,598 lb., which equals 2,296 bushels. It is hoped that during the coming year a considerable extension will take place in this direction, especially looking to the distribution of selected seed corn, which will doubtless raise the standard of the product.

Among minor industries it is satisfactory to note that there has been a continued increase in the planting of ground nuts and peas, as shown by the amounts exported. In 1916 the value of ground nuts exported was £3,660, and of pigeon and black-eye peas, which are the chief varieties grown, £2,070. This leads one to remark on the great interest that is evidently being taken in the island in increasing the production of local food products. The efforts of the Agricultural Superintendent to demonstrate that St. Vincent could produce sufficient quantity of foods, and in such variety as to enable the population to feed itself, are most praiseworthy, and seem to be meeting with deserved success.

Now that the question of education is being discussed, it is noticeable that in St. Vincent it has been decided to substitute for the six agricultural pupils two cadets who have had secondary school training. This step has been taken owing to the difficulty of obtaining suitable boys as agricultural pupils. In the selection of cadets preference will be given to candidates who have passed the Cambridge Senior Local Examination. These cadets will have a two-years' course of training in theoretical and practical agriculture, and it is hoped that they will be able to take the Intermediate Examination of the Imperial Department of Agriculture at the expiration of that period.

As has been already noticed, the meteorological conditions of the year 1916 were abnormal. The rainfall—137.63 inches—was the heaviest ever recorded at the Botanic Gardens. It was 29.89 inches above the mean of the past twenty-three years. In the month of November alone the rainfall recorded was 32.52 inches.

It is pleasing to note from the report of the Government Veterinary Surgeon that there has been no case of anthrax reported in St. Vincent since October 1914. The total number of animals exported under certificate for the year 1916 was 4,821, of the total value of £8,331 13s. 2d.

THE USES OF DASHEENS, TANNIAS, AND EDDOES.

Among the most valuable economic crops of tropical and sub-tropical regions are certain species of the Arum family. These belong almost exclusively to the genera *Xanthosoma* and *Colocasia*. They are known in the West Indies as tannias and eddoes, or 'cocoas' in Jamaica, and one of the *Colocasias* (*C. antiquorum*)—which is only cultivated in the wetter islands, such as Trinidad and Dominica—is known as 'dasheen'. This is apparently identical with the 'taro' of the Polynesian Islands, and has apparently been introduced into the West Indies in comparatively recent times. When it was first cultivated in Trinidad the writer of this article does not know, but in an article in the *Yearbook* of the United States Department of Agriculture, 1916, it is stated that a variety of the taro has been introduced into the Southern States from Trinidad, and is rapidly becoming established as a factor in the agriculture of those States, under the name of 'dasheen' by which it is known in Trinidad.

The article referred to states that, as the dasheen contains about 50 per cent. more protein, and 50 per cent. more starch and sugar than the potato, it would be a cheaper food at equal prices. This crop is best suited for cultivation in rich moist soils, and requires about seven months to mature.

The name 'dasheen' seems probably to be a French West Indian patois corruption of 'de la Chine', in vague allusion to its exotic origin. Mr. J. Jones, the Curator of the Botanic Station in Dominica, thinks that this is most probable, as the patois-speaking inhabitants of that island speak of a variety of orange as 'orange dasheen', and we have long spoken in English of 'China oranges'. Mr. Jones says that the dasheen was introduced into Dominica from the neighbouring French island of Martinique about thirty years ago, and has become one of the most widely grown and popularly esteemed vegetables in Dominica. Throughout the West Indies, however, there have always been cultivated other species of *Colocasia* or eddoes, and many varieties of *Xanthosoma*, or tannias, although the names are hopelessly confused by local usage in various islands. Both of these genera are related to the showy *Caladiums* and *Alocasias* cultivated as garden plants; these two genera, however, not being of food value. An easy way of distinguishing between the tannia (*Xanthosoma*) and the eddoo or dasheen (*Colocasia*) is that the leaf of the former is sagittate or arrow-shaped, that is, the leaf is attached to the stalk at its upper margin, and is the shape of an arrow-head, whereas the leaf of the latter is joined to the stalk more or less towards its middle, and so is denominated peltate, or shield-shaped.

Varieties of both of these genera must have been cultivated by various races of men for thousands of years, for some of them have lost the habit of producing fertile seeds, even under the most favourable conditions, and are only vegetatively reproduced by cuttings from the rhizomes.

In all the cultivated species the rhizome is the part of the plant that is of chief economic value, though the leaves, and especially the unopened leaf shoots are not to be lightly esteemed. These plants are widely grown not only in tropical America, but throughout Polynesia, and in parts of China and Japan, thus forming a valuable article of food for millions of the human race. Wherever grown they are considered very nutritious and easily digestible.

In furtherance of the wise policy referred to in another article of this issue, the Bureau of Agriculture collected varieties of these aroids from every part of the world where they were grown; and after field tests made in experiment stations

in the Southern States, it was concluded that the Trinidad dasheen was most worthy of cultivation in that region, as being best adapted to the climatic conditions.

Hence, as was said before, a considerable interest is being shown in its culture and uses. West Indian, especially Barbadian, planters are well acquainted with the methods of cultivating the various tannias and eddoes for the sake of their rhizomes, but the article, in the *Yearbook*, to which reference has already been made, describes a method of cultivation for a purpose which, as far as the writer of this article knows, has never been practised in these islands, but which seems well worth a trial. As has been stated in a former number of this Journal, the leaves, especially the young unopened ones of tannias or eddoes, can be used to provide an excellent spinach. In the Southern States, however, the large corms of the dasheen are forced, in order to provide blanched shoots. For this forcing and blanching large corms are planted in a bed of moist sandy soil, and the bed is closely covered with boarding to exclude light, so that the shoots may be thoroughly blanched. It is said that these blanched shoots are more tender than asparagus, and have a delicate flavour, not unlike that of fresh mushrooms. They contain, however, a slight acidity, which is destroyed by proper cooking. The following are given as good recipes for cooking these blanched shoots:—

(1) Cut the blanched shoots into 2-inch lengths, pour on an abundance of boiling water, add salt to taste, and boil for 12 minutes; drain, pour on enough cold milk to completely cover shoots; bring it to the boil, season if necessary with more salt, and continue boiling for 5 minutes; drain, season with butter, and serve on toast, or plain, with a milk sauce.

(2) Instead of boiling in milk after the first draining, add a little piece of butter or bacon, then cover the shoots with cold water, season with salt, and boil for 5 minutes. Drain and serve.

Neither the cultivation nor the cooking of these shoots seems very difficult—probably any cultivated tannia or eddoo could be treated in this way successfully. Should any of our readers care to experiment in the direction, we shall be very grateful for any account of the results obtained.

The article from which the foregoing recipes are taken contained directions for cooking dasheens in very many ways. It is considered that baking is the most satisfactory method in general of cooking either large or small dasheens. The large corms should, however, be first parboiled for ten to twenty minutes.

Dasheen crisps are made in the following manner: raw dasheens are pared, and sliced thin, and fried slowly to a light brown in deep fat. This is declared by some epicures to be the most delicious of all ways of preparing dasheens for the table.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. LUCIA. The Agricultural Superintendent, Mr. Archibald Brooks, in his notes on items of departmental interest during the month of October, reports the following plant distribution from the Experiment Stations: limes 3,400, grafted mangoes 15, budded oranges 50, economic plants 6, and ornamental plants 29. In addition 1 packet of vegetable seeds was sent out.

Regarding staple crops, the condition of cacao is reported normal; the lime crop is slackening, but extension in cultivation continued good; while the sugar crop is reported as promising: a considerable shortage of manure, however, is noted.

Fifty casks of concentrated lime juice were shipped from the Government Lime Juice Factory—30 more await shipment. A report on the agricultural teaching requirements of the colony has been submitted by the Agricultural Superintendent.

The rainfall recorded at the Botanic Gardens, Castries, for the month was 8.93 inches, and at the Agricultural and Botanic Stations, 8.44 inches.

In a further report for November, Mr. Brooks describes work of a general routine nature both in the Experiment and Botanic Stations. Plant distribution included 2,400 lime plants, 8 grafted mangoes, 7 budded oranges, and 17 ornamental plants. There were also distributed 19 packets of vegetable seeds.

Touching staple crops, the cacao crop and second crop of limes are being reaped, and reaping operations have also commenced in respect to sugar. Thirty-nine casks of concentrated lime juice, and 16 cases of distilled lime oil were shipped during the month from the Government Factory, while 29 casks of concentrated lime juice await shipment. Mr. Meaden, of the Agricultural Department, Trinidad, arrived in the island to study the management and working of the Government Lime Juice Factory.

The Agricultural Superintendent spent the greater portion of the month in Trinidad, where he visited various estates and lime factories, and studied the working of the large coco-nut oil factories on the Windward coast. Much information has been gained, which should prove serviceable if a similar factory be erected in St. Lucia.

The rainfall recorded at the Botanic Gardens, Castries, for the month was 3.80 inches; and at the Agricultural and Botanic Station, Choiseul, 2.23 inches.

St. VINCENT. Mr. W. N. Sands reports work of a general routine nature in the Botanic Gardens during the month of November, including an experiment to ascertain the purity of the selections of B. S. strain of cotton, before the next planting season. The weather was fairly dry, but suitable for ripening of cotton, which was opening up well in most districts. Bush bugs continue to cause damage in certain localities. Striking results of the beneficial effort of the campaign against the cotton stainer were evident. This will be the subject of a special report in due course. Ginning of the new cotton crop has been started, and the reaping of arrowroot is in full swing. A further shipment to England of 35 tons of kiln-dried corn was made. This is evidence of the success that has attended the praiseworthy efforts put forth in St. Vincent to stimulate interest in the production of local food crops, and of the whole hearted response which has been made by the people of that colony, and which is worthy of emulation by other colonies.

Appended to this report is a summary of work undertaken in conjunction with the Mycologist and Entomologist of this Department, in connexion with study of bush bugs and other pests; and diseases of cotton and limes.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of October 1917:—

There is but little or no change to report on the condition of the London produce markets during the month of October from that of our report for September. Consider-

ing the dangers and difficulties in import traffic business, on the whole it is remarkably well maintained. Purchases, however, are being made only in such goods, and in such quantities, as are absolutely necessary to meet current requirements, with very slight variations either in bulk or prices. Of those that may be specially noted as commanding higher rates are mace and kola.

GINGER.

At the first spice auction on the 4th of the month, it was stated that some small sales of Sierra Leone ginger had been made in Liverpool at 49s. per cwt. A week later in the London market the prices stood thus: washed Cochin 68s. to 70s.; Sierra Leone, of which 104 bags were offered fetched 57s. to 58s. for fair. The following were also offered, and bought in, 198 bags of fair limed Japanese at 47s., 345 bags of Cochin at 70s., and 75s. for brown rough Calicut. At the last spice auction in London on the 25th of the month, 268 bags of rough washed Cochin were bought in at 70s. There were also offered 172 bales and 120 baskets of good brown Calicut, all of which were bought in at 67s. per cwt. Mace was also in good supply at auction on the 11th of the month, when 19 cases of Java were offered and sold, 3s. 3d. per lb. being paid for fair curly pale red, ordinary fetching 3s., and pickings 2s. 10d. At the last spice auction on the 24th of the month, mace was represented by a full supply of West Indian, 21 barrels of which fetched 2s. 7d. per lb. for broken and pickings. Fifteen packages of broken and mixed Macassar fetched without reserve 2s. 7d. to 2s. 11d. per lb.

SARSAPARILLA.

This drug has been in good supply but in very little demand. At auction on the 18th the offerings were as follows: grey Jamaica 16 packages, Lima-Jamaica 13, native Jamaica 8, and Honduras 3. The only sales effected were for 4 bales of the Lima-Jamaica, which fetched 3s. 3d. per lb. The grey Jamaica was withdrawn at 4s. per lb. It was stated that some private sales had been effected with some of the native Jamaica at 2s. 3d. per lb.

ARROWROOT, LIME JUICE, PIMENTO, KOLA, CITRIC ACID,

CASHEW NUTS, and CASSIA FISTULA.

At the beginning of the month the quotation for arrowroot was 5½d. per lb. for ordinary manufacturing St. Vincent. A week later it was stated that 200 barrels of St. Vincent had arrived, which was being disposed of at 5½d. to 6½d. per lb.

Owing to the demand for lime juice by the Government, together with a reported decrease in the import, an advance of 3d. per gallon was made in the early part of the month, and 3s. 3d. to 3s. 6d. per gallon was asked for good quality juice. At the close of the month it was reported that as much as 3s. 9d. was being asked for fine pale raw juice. Pimento was in quiet demand at the beginning of the month at 4d. per lb. At auction at the close of the month some 500 bales were offered and disposed of at 4½d. per lb. Kola was represented at auction on the 18th of the month by 313 packages, 62 packages only finding buyers at an advance of 2d. per lb. on previous rates, good bright Java fetching 8½d. per lb.; 10d. was asked for some good Java halves, while 2 bags from Dominica of fair quality sold at 8½d. per lb. Citric acid has maintained a steady sale at 3s. 3d. per lb. throughout the month. Cashew nuts were represented at auction on the 18th of the month by 12 packages, all of which were disposed of privately. Nineteen packages of Cassia Fistula pods were also brought forward at the same auction, but failed to find a buyer.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR,
November 1, 1917.

ARROWROOT—5½d. to 6½d.
BALATA—Venezuelan Block, 3/2½; Sheet, 3/9½ to 3/11.
BEESWAX—No quotations.
CACAO—Trinidad, 87/- to 95/-; Grenada, 90/-; Jamaica, no quotations.
COFFEE—Jamaica, 72/.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, 100/- to 110/- per cwt.
LIME JUICE—Raw, 2/6 to 3/-; concentrated, no quotations; Otto of lime (hand-pressed), 16/-.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—No quotations.
RUBBER—Para, fine hard, 3/1; fine soft, no quotations; Castilloa, no quotations.

New York.—Messrs GILLESPIE BROS. & Co., November 27, 1917.

CACAO—Caracas, 12½c. to 13c.; Grenada, 12c. to 12½c.; Trinidad, 12½c. to 13c.; Jamaica, 9½c. to 10½c.
COCO-NUTS—Jamaica and Trinidad selects, \$48.00 to \$50.00; culls, \$32.00 to \$34.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—16½c. to 20c. per lb.
GOAT SKINS—Jamaica, 80c.; Antigua and Barbados, 70c. to 75c.; St. Thomas and St. Kitts, 65c. to 70c. per lb.
GRAPE FRUIT—Jamaica, \$3.00 to \$3.75 per box.
LIMES—\$4.50 to \$5.00 per brl.
MACE—32c. to 38c. per lb.
NUTMEGS—18½c.
ORANGES—\$2.50 to \$3.75
PIMENTO—5½c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 6.90c; Muscovados, 89°, 6.64c.; Molasses, 89°, 5.75c. all duty paid.

Trinidad.—Messrs. GORDON, GRANT & Co., November 22, 1917.

CACAO—Venezuelan, \$11.25 to \$11.50 Trinidad, no quotations.
COCO-NUT OIL—\$1.30 per gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—7½c. per lb.
DHAL—No quotations.
ONIONS—\$8.00 per 100 lb.
PEAS, SPLIT—\$12.00 to \$12.50 per bag.
POTATOES—English, \$4.50 to \$5.00 per 100 lb.
RICE—Yellow, \$10.50 to \$11.75; White, \$9.25 to 9.50 per bag.
SUGAR—American crushed, no quotations.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 30, 1917.

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MOLASSES—No quotations.
ONIONS—\$12.00.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$6.75.
RICE—Ballam, \$10.00 to \$10.80 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, no quotations.

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Stimulation of Interest in Education.

IN the series of articles that have already appeared on this subject reference has been made to general education in elementary and in secondary schools, and to the necessity in rural schools for ensuring that the teaching there given shall be such as will induce the pupils to be observant of the natural phenomena of their surroundings in daily life, which will lead ultimately to a rational outlook with regard to the main concerns of rural communities, and their agricultural industries. Reference has also been made to the technical training that may be given to the pupils of the secondary schools, after they have spent some years in acquiring knowledge on broad humanistic lines. It is desirable

now to say something with regard to technical education in respect to pupils from elementary schools, and to see what means are available for enlarging the outlook of the more apt or better equipped of the pupils from these schools.

This matter was considered in the article in the *West Indian Bulletin*, Vol. XIV, p. 172, to which reference has already been made; it may be well therefore to quote again from that article:—

‘Should it be desired to afford training of a somewhat more advanced and technical character, some institution other than the elementary school must be looked to.

‘It must be remembered that the numbers that are to receive this more advanced training will be very much smaller than those attending the elementary schools, and that the pupils so trained will stand out above the ordinary agricultural labourer, and will look for minor positions of trust carrying higher rates of wages than those of agricultural labourers.

‘A system of training in some institution where work is carried on for other than educational purposes seems best calculated to meet the requirements of this class. The system may approximate to one of apprenticeship, though the use of this term, particularly in some of the West Indian colonies, has connotations rendering it undesirable.

‘In most colonies there are Botanic Gardens and Agricultural Experiment Stations where there is a considerable amount of routine work, much of which is capable of being done by agricultural pupils drafted from the elementary schools. The work carried on in these institutions necessarily has a close connexion with the agriculture of the neighbourhood, so that pupils

can be trained in work that has real association with the local agricultural industries; and they may be trained to acquire a fair perception of the needs of these industries. Their training may consist chiefly in carrying out routine operations, and in learning to perform these intelligently and dexterously. In order to minimize the danger of these pupils drifting down and being regarded merely as labourers, as well as to increase their usefulness, it is necessary that they receive a certain amount of theoretical instruction, in addition to their acquiring manual dexterity in agricultural operations. This may be accomplished by giving an hour's class instruction daily, or perhaps preferably, by devoting one day a week to this form of instruction. The instruction so given should be calculated to afford an insight into the reasons underlying the operations of a practical character in which they are engaged.

It is desirable that pupils of this class should receive a small monetary payment by way of subsistence allowance; the amount must be regulated by local conditions; it should increase progressively, say, half-yearly, and the acquirement of the increment should be contingent on diligent work and good behaviour.

It is undesirable that these pupils should be boarded and fed at the institution where they are trained. They and their parents or guardians should make arrangements for their living under conditions having the approval of the authorities responsible for their training. These conditions will much more closely approximate to those in which the pupils find themselves in taking up wage-earning work; while the acquiring of ability to look after their own affairs in the matter of food and clothing is training of considerable value, which is lost if the pupils are boarded and fed by the educational authority. Further, valuable training is acquired in that the pupils gain a knowledge of the manner of governing their conduct out of working hours; they find how to obtain reasonable recreation, and they acquire a sense of individual responsibility beyond what can be obtained under a system of boarding together with its consequent rules and regulations. On leaving the institution where they have been trained in order to take up wage-earning employment, the change in the manner of living is less violent, and the individual has useful experience to guide him.

Such a course of training should suffice to produce the higher grades of labourers and the types of head men who find so large a place in

tropical agriculture, men who can work with their hands, or, in subordinate capacities, supervise the work of others.

The planning of this phase of work requires particular care. There is too frequently present in the minds of those responsible for it, that the purpose will be served by teaching the rudiments of botany, chemistry, and other sciences having a bearing on agriculture. This idea is wrong and misleading, and has probably been responsible for much disappointment on the part of those who have been desirous of advancing the educational welfare of pupils of the class under consideration. In respect to this class of pupils, agriculture and horticulture require to be regarded as arts—things to be done. The rules and the reasons for the operations will be furnished by those who are directing the operations, rather than by the subordinate work-people engaged in carrying them out. There is abundant scope for useful teaching, as anyone who has had practical experience in field or garden well knows. Just what lines of instruction should be followed must be determined by the nature of the occupations of the district in which the school is situated. The work of the Experiment Stations and Botanic Gardens is determined mainly by the agricultural interests of the districts in which they are situated, thus affording an ideal means of giving instruction in work directly related thereto.

It would seem a comparatively easy matter to devise a series of scholarships from the elementary schools, to enable a limited number of pupils from some, if not all, of the schools to receive instruction on the lines indicated, at the Botanic Garden or Experiment Station of each colony.

In countries where the cultivation of sugar-cane is the principal industry, there may be some difficulty of finding the means of introducing these trained workers into the general economy of the estate, except through the ranks of the labourers. A great incentive to acquiring the training will be given, if some better method can be thought out; but there is little doubt that workers so trained will quickly show their worth, and will be advanced to positions of minor responsibility: they should form a body whom the managers of estates will be glad to have and to recognize. It is more than likely that the introduction of motors for ploughing, cultivating, and other operations of the plantation, will afford openings for youths who have received the better training. At the same time their services should be welcomed to fill the ranks of the more skilled

workers on the plantation, such as those engaged in ploughing, the working of weeding machines, and the care of live stock.

Cotton growing gives rise to a demand for skilled workers of the labourer class, who can be entrusted with the work of planting and caring for the crop, and the control of the pests and diseases to which the crop is liable; and this in perhaps a greater degree than is seen in the sugar industry.

Where orchard work is engaged in, such as the growing of cacao or of limes, there arises a demand for skilled labourers; for in these industries there is much work in connexion with planting the trees and pruning them, and in handling the crop, that has to be done by labourers working more or less alone, as distinguished from the working in large gangs which characterizes the work of some industries. Here the worth of training is soon felt, and a good workman is valued, and should be remunerated accordingly.

From this, perhaps, it follows that the training of pupils in Botanic Gardens and Experiment Stations will find most favour in cacao and lime-growing countries, though it is probable that the effort to diversify industries, which is now evident, will lead to an early extension to sugar and cotton-growing regions of this means of training; while this will probably be hastened by the increasing use of implements and motors in agricultural work, and the necessity these will create for skilled workers.

In all communities there is a demand for gardeners, though this demand may be quite small in some of them. The Botanic Gardens and Experiment Stations afford excellent training ground in which the limited numbers of skilled workers of this class may be readily produced, without the necessity for setting up any elaborate training institution.

On surveying the whole question of agricultural instruction, it should be recognized that there already exist in these colonies valuable means for giving instruction. What is needed on the part of those directing affairs is that they shall carefully study the facilities thus existing, and endeavour to use them to the fullest extent, and out of them to develop further and better means of education. The means are within reach, and in many cases involve but little expense in procuring their utilization. Such a course is more likely to be attended with success than efforts at the present time to create entirely new organizations for teaching purposes.

POTASH FROM KELP.

Until the beginning of the war the supply of potash as a fertilizer was almost a monopoly of Germany's. In 1915 Germany prohibited the exportation of all potash salts. This action stimulated the attempt of American manufacturers to produce potash, and resulted in the erection of large plants in Southern California for the extraction of this material from kelp. Along the Pacific coast of North America are found beds of giant kelp of several species. These huge sea-plants sometimes grow into a length of 100 feet, containing a surprising amount of potash salts. According to an article in the *Yearbook* of the United States Department of Agriculture, 1916, dried kelp of the most important species will yield from 25 to 30 per cent. of potassium chloride. These species of kelp appear to be one of the most hopeful sources of an adequate supply of potash for fertilizing purposes. Eight large factories are operating with an aggregate daily capacity for dealing with 2 500 tons of raw kelp, yielding approximately 10 per cent. of dried kelp. The reaping of the kelp is however not without difficulties. The beds are located close in shore, almost all of them within the 3-mile limit. The kelp is harvested by cutting the upright stems from 3 to 6 feet below the surface, which secures not only that portion but also the much larger portion which floats on the surface of the water. The plants are non-fibrous, and of a gelatinous nature, which makes it almost impossible to extract the water they contain, which has to be removed by pressure.

Several methods have been suggested for treating these kelps with a view to their utilization for fertilizer purposes. The simplest is to dry and grind the material, and market the product for direct application to the soil. The dried, ground kelp contains 25 per cent. potassium chloride, 2 per cent. nitrogen, and organic matter of value for improving the condition of the soil by the formation of humus.

Another process is to burn the dried kelp, and market the ash for its potash content. By this process, however, the value of the nitrogen is volatilized and lost, and a small part of the potash content is similarly destroyed.

Another process, which seems most likely to succeed eventually, is to distil the dried kelp in retorts constructed on the general principle of the by-product coke oven. This results in a charged residue containing all the potash salts, which may be recovered by leaching and evaporation. In the process of distillation the nitrogen is driven off and recovered in the form of ammonia. Combustible gas is evolved in considerable quantities, and is available for use as fuel in the retorts and under the evaporating vats, and charcoal and tarry products are recovered which may be sold or used as fuel. Iodine and some other by-products may also be recovered.

If the kelp grew on the eastern sea-board, close to the regions of large fertilizer demands, the first method of treatment would probably be the most economical and satisfactory. The kelp, however, occurs on the western sea-board, and the heavy freight charges on the transportation of the dried kelp, three-fourths of which consist practically of valueless matter, would prove too heavy an item to permit of successful competition with importations of potash salts from mines in other countries. Investigations are now being made with the hope of transplanting the Pacific kelp to the Atlantic coast, and successfully growing it there. If this should be accomplished, and the plants established in extensive beds, dried ground kelp would undoubtedly become a widely used fertilizer on eastern farms.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. The Curator (Mr. Joseph Jones) reports the following plant distribution during the month of November: limes, 1,275; cacao, 100; budded citrus, 32; grafted mango, 1; shade trees, 650; miscellaneous, 45; making a total of 2,103. In addition, 269 packets of vegetable seeds were sold. Work in the Botanic Garden and Experiment Stations was of a general routine character. Concerning staple crops it is stated that a good second crop of limes is now coming in. The price of ripe limes is 7s. per barrel. The weather is favourable for ripening and drying the cacao crop. With regard to onions, 24 lb. of Teneriffe onion seed were received and distributed. Black blight on lime trees is still reported as being prevalent in several districts. The weather was dry, and, like that experienced during October, was unusual for the time of the year. The rainfall for the month was 1.92 inches.

MONTSERRAT. The sweet potato and corn plots in the Experiment Stations, the Curator writes to say, were reaped with very moderate results. The experiment in growing beans over pigeon peas does not promise to be very successful. A fairly promising second crop has developed on the cotton breeding plot. Plant distribution included 2,050 bay plants, 2,360 cane cuttings, 32 lb. black-eye peas, 36 mahogany plants, and 18 golden apple plants (*Spondias dulcis*). Five distillations of bay leaves were made in the Botanic Gardens, giving a total of 6,000 lb. leaves reaped from the experiment plot for 1917. The lime experiment plot in Belle field has recently suffered severely from attacks of purple scale, and has received a considerable set-back. A fairly large plot of the ajowan plant has been sown. Seeds of berseem and *Hyoscyamus* failed to germinate. In his observations relating to staple crops, Mr. Robson states that, except in the northern districts, the reaping of the cotton crop has been practically completed. Moderate crops have been obtained on most of the estates, and it is questionable whether the estimate of 400,000 lb. of lint for the total crop will be reached. A good second crop will be picked only from a very limited area. The benefit of early planting has been very marked in the present season.

The preparation of land for next season's crop has commenced, but all planters complain of difficulties with labour. With regard to pests, leaf-blister mite is said to be much more prevalent than usual on the second growth of cotton, and cotton stainers are plentiful in districts where, as a rule, they are not troublesome, and vice versa.

The bulk of the work in connexion with cotton selection has been completed, and there is seen to be great improvement in the inheritance of the characters examined as the result of one year's breeding, particularly in the percentage of lint. Visits were made to all the cotton-growing districts in connexion with the fixing of a date for the destruction of old cotton plants. The distillery was also visited in relation to the difficulties with the bay oil distilling apparatus. The onion seeds received at the close of last month were distributed to 160 persons. There is much less enthusiasm over this cultivation, as the seeds arrived so late. Mr. Robson points out that it would be very useful to have the results obtained in St. Vincent from the destruction of the host plants of the cotton stainer, as local action in this respect is held over pending the result of the work in that island. [Present information from St. Vincent is to the effect that the campaign for the destruction of the host plants of the

cotton stainer, referred to by Mr. Robson, has been productive of highly successful results, a report on which has been forwarded to the Government of the Leeward Islands.] The rainfall recorded at Grove Station during the month was 4.75 inches; the rainfall for the year is 65.50 inches.

ANTIGUA. Mr. T. Jackson, the Curator, reporting for the month of November, describes work of an ordinary routine nature in the Experiment Station and also in the Botanic Gardens. Plant distribution was as follows: henequen, 2,700; bay plants, 1,476; coco-nut plants, 463; miscellaneous, 11. In addition, 115 lb. of cotton seed, and 12 packets of miscellaneous seeds were sent out.

On the whole, the cane crop of the island improved during the month. The onion seeds received have germinated well throughout the island. The cotton crop, although late, looks very promising. The granary was opened during the month, and a small quantity of corn was dried. Four plots were taken up by peasants at Sawcolts: up to date twelve plots have been allotted. For the Antigua Cotton Growers' Association 866 lb. of seed-cotton was purchased, making a total of 2,111 lb. purchased to date. Attacks of cotton caterpillars were experienced during the month. The rainfall for the month was 5.28 inches; for the year, 37.06 inches.

Attached to the above is a brief report on the work of agricultural instruction during the month of November. This shows that all the peasants' holdings in which cotton is being grown were severely attacked by cotton caterpillars. In some cases the trees were so badly defoliated that only a mass of reddened stems were to be seen standing. Strenuous efforts were made to control these pests by repeated dustings with Paris green and lime, and, in some instances, with London purple and lime; but, owing to the constant showers of rain which fell at the same time, these were of little or no avail. Picking has been in progress during the month. Cotton stainers made their appearance in the fields during the first week of the month. Preparation of land, and the planting of ground provisions have been started.

BARBUDA. Observations relating to crops and stock on the Government estate, Barbuda, forwarded by the Agricultural Instructor, Mr. C. A. Gomez, for the month of October, show that the growth made by the younger cotton fields was arrested by the very limited rainfall experienced during the month. The dry weather, however, proved ideal for the picking of the more advanced cotton fields at Guava. The picking of the crop in both districts was commenced at the end of the month, when approximately 4,000 lb. of seed-cotton was gathered. Cotton bolls are showing signs of maturing, and within the next two weeks the picking of the crop will be in full swing. The crop now being reaped is the earliest on record, and is maintaining its hopeful prospects. Activities in cotton fields consisted in weeding young cotton, and the picking of the more advanced sections of the field. Cotton worms and other pests have been singularly absent up to the present. With regard to stock, it is stated that, in spite of a dry October, an adequate supply of fodder was produced in the pasture for the requirements of the stock. The cattle are in excellent condition, the young steers and heifers developing rapidly. Hot, dry days with calm north winds prevailed throughout the month. Rain fell on four days only, and a total precipitation of 2.41 inches was recorded.

From the Experiment Station, the following plants were distributed: 500 onions, 5,000 sweet potato cuttings, 59 packets of miscellaneous seeds, such as peas and

beans. Exceptionally high yields were obtained in the ground nut experiment. The variety Dixie Giant headed the list with a calculated yield of $1\frac{1}{2}$ tons of nuts per acre, followed by Virginia with a calculated yield of 1 ton per acre. The area devoted to the ground nut trials was $\frac{1}{10}$ acre. Peasants' provision grounds continue to yield small crops of peas, beans, and corn, and, considering the prevailing high price of imported foodstuffs, they have been of great benefit to the inhabitants.

ST. KITTS. Mr. F. R. Shepherd, Agricultural Superintendent, writes to say that general routine work was performed in the Botanic Gardens during the month of November, while in the Experiment Station the reaping of various plots was carried on. Plant distribution included 37 lb. of peanuts, 23 lb. of peas, 1,500 sweet potato cuttings, 10 lb. of white velvet beans, 7 lb. eddoes, and a quantity of Mazzagua corn sent to the Agricultural Department, Mauritius; while 59 ornamental plants were distributed from the Botanic Station.

The condition of the old cane crop, especially in the Basseterre district, is worse than at this time last year. The very small rainfall has had no effect on the growth of the cane, and arrows are in abundance. The outlook for next season, especially on estates connected with the factory, is a poor one, and little more than half a crop may be expected. On the northern side of the island the muscovado estates are looking better, and the rainfall has been greater. The planting of the young crop is in full swing, but rain is much needed for good germination.

The cotton crop is nearly all picked. Returns have not been as large as were expected, the dry weather preventing the full development of the later bolls. Cotton stainers are to be seen in the fields of cotton that are being kept for a second bearing, but in the majority of cases the bushes will soon be turned under for planting cane. The rainfall for the month was 2.31 inches; rainfall for the year, 35.89 inches.

In the appended summary of work performed at the Government Laboratory during the month, mention is made of analyses of sixteen samples of milk from the Inspector of Police.

TORTOLA. In his report for the month of November the Curator, Mr. W. C. Fishlock, states that the only plants distributed from the Botanic Gardens were 6 coco-nut plants, together with 2 packets of vegetable seeds, and 80 lb. of cotton seed (sold).

The condition of the cotton cultivation is, generally speaking, poor. In regard to staple crops generally there was no special progress to report. Cotton worms were seen in the Experiment Station, and the usual remedy was applied. The weather during the month was showery; rain fell in measurable quantity on twenty-one days. The total rainfall at the Experiment Station was 8.22 inches, as compared with 7.34 inches, the average for the month for the preceding sixteen years.

AGRICULTURE IN BARBADOS.

Few things could have been more unexpected than the protracted drought through which the island is passing. The latter part of October was dry; on only one day during November was there a heavy rain, and December so far has been very dry. As far as our records go, not since 1880 has there been a December quite so dry as this. The weather during December last year was unfavourable, but up to the middle of the month there had been a rainfall of between 2 and 3 inches. This year few districts have as yet recorded more than $\frac{1}{2}$ -inch for December.

The application of farmyard and sheep manure still goes on apace. It will be the end of January before the manuring of the young crop is an accomplished fact. The amount of manure made up prior to October seems to have been less than usual, and the drought has caused a further shortage, owing to the fact that the yield from the pastures has been adversely affected. We are more and more convinced that pasture land is a most valuable asset, and that it should be kept 'in heart' by the application, at intervals, of manure in some form.

Tillage too is as yet incomplete. Forking, draining, and headrow-making are still in progress. Most fields are clean, for gangs have been everywhere at work uprooting the grass, and the dry weather has considerably aided their efforts. Some of the fields which have been recently forked and drained present an excellent appearance, and reflect great credit both on the labourers and on those who have supervised the work. We should like to have seen more moulding done where material was available. We believe in this: it is as helpful as manuring.

In the black soil practically all the young crop has been planted, and some supplying is being done in the fields which were first planted. The germination, as was to be expected, has been poor.

With the present weather, it is merely a platitude to state that the old crop is being seriously affected. Unless January is a very favourable month, we should not be surprised if the results next year showed a shortage of 50 per cent. It is recognized that the fourth quarter of the year is the most critical period in the existence of the sugar-cane. We would mention that the Ba. 6032 has shown considerable resisting power during the past month. This seedling is indeed not only hard, but a hardy variety.

We need to have in our fields the natural enemies of the sugar-cane pests. Nothing can be a substitute for these. Years ago these enemies roamed unmolested through our fields, and did their duty well, but they have been practically exterminated by the mongoose. Destroy the mongoose and Nature's order will be restored. Even the blackbird is hindered from effective duty by the mongoose, which, though useful in other parts of the world, should not exist in this island. (*Agricultural Reporter*, December 15, 1917.)

We are glad to report that since the above was published, there has been a fine fall of rain, general throughout the island, on the 24th and 25th instant.

[ED. A.N.]

Abnormality of the Jamaica Hurricane.—

Miss C. M. Hall, Assistant Government Meteorologist, Jamaica, has recently issued a report on the hurricane that passed over that island on September 23, 1917. From this report it appears that when the atmospheric depression was forming south of San Domingo, it was unlikely that there were then two centres, but probably, on coming within the influence of the Jamaica Blue Mountain, range it split in two, one centre passing north, and one south of the range, both moving parallel to it. The two centres reached the east end of the island at 2 a.m. on the 23rd. The south centre moved at a uniform velocity of $17\frac{1}{2}$ miles per hour, but the north centre, having either stopped or moved very slowly for the first hour, subsequently rushed inland, moving at a rate of 20 miles per hour. These two centres produced a good deal of apparent confusion in the direction of the wind at almost every place in the island. The east end suffered severely from separate or joint effects, the west end hardly at all, but the velocity of 40 or 50 miles maintained by the wind of course destroyed the bananas.

SELECTION OF CORN FOR SEED.

Greatly increased interest has of late been shown in many of the West Indian islands with regard to the cultivation of maize or Indian corn; notably so in Grenada and St. Vincent. The latter island especially, as is shown by recent reports of the Superintendent of Agriculture, has made great progress in this direction. During the last two months, in addition to fully supplying local requirements, the crop of maize grown has been sufficient to allow of the export of 85 tons of grain to the United Kingdom, which is a decidedly good record for this small island. It would appear that owing to careful selection for seed purposes of corn of the native varieties, the crop has been largely increased. The subject seems of sufficient importance to render valuable the reproduction of the substance of an article on the selection of seed maize by H. Wenholz, B.Sc., Inspector of Agriculture, which appeared in the *Agricultural Gazette of New South Wales*, August 2, 1917. The writer says that from the earliest times it is probable that some attention has been given to the selection of maize for seed. The first method of selection was probably that of keeping the largest ears for this purpose. This crude method, though still employed to some extent, does not make for much improvement, as such ears may have been produced under specially good conditions which may not be present the following year.

A further step in improvement by selection has since taken place, viz., the choosing of a certain type which is supposed to be correlated with increased yield. When this type represents the majority in a well acclimatized variety, it is probable that some improvement in yield is effected.

There are, however, certain fundamental points in the selection of seed ears of any variety of maize, the observance of which makes for continuous improvement. The chief of these points are weight of ear and percentage of grain per ear, shape, length and circumference of ear, filling of tips and rounding of butts, uniformity, depth, and shape of grain, and space between the rows and grains. Combined with greater attention to field characters, and to uniformity in the main characters which define a variety of maize (period of maturity, colour of grain and core, size of grain and character of dent,) it is possible to effect fairly rapid improvement, especially by the establishment of special seed plots in which cross-fertilization takes place only between these more desirable types.

If the conditions during a particular season have been such that the standard ear length of the variety grown is not reached, it is usually thought that the crop is not good enough for seed, and the general practice is to introduce fresh seed from an outside source. This practice is to be strongly condemned. Owing to its not being acclimatized, the introduced seed cannot put forth its maximum production, and loss of yield results until the new strain becomes thoroughly adapted to its new environment of climate and soil.

One of the most important points in the selection of seed ears is to choose those of average size, which, when dry, are heavy in proportion to their size.

A common practice in selecting seed ears is to get deep grain, with a small cob, but by following this idea too rigidly some decidedly wrong results will be obtained. In the first place, a small cob usually means fewer rows and less grain than on a cob of moderate size. Secondly, under good rainfall conditions there is a tendency for the cob to become larger. In this case the selection of ears with a small cob is simply going in the contrary direction to the influences of the environment to which the type is being adapted.

As a general rule, the cylindrical ear is the more desirable type for selection than the tapering, because it carries more grain. A cylindrical ear will also contain grain of uniform size, shape, and depth, almost right up to the tip. Selection for straightness of rows and regularity of grain is also desirable. Ears with twisted rows, or with irregular grain will not only increase the number of such ears in the crop, but will also render the irregularity more pronounced.

Selection for depth or length of grain has been given, perhaps, more attention than any other character, and there is no doubt as to the value of selecting for this character in order to increase the yield. One point, however, that is often overlooked in selecting for deep grain, is the fairly general rule that ears with a rough dented grain have deeper grain than those with a smooth dent.

In the selection of seed ears more attention should be paid to uniformity in the appearance of the ears, and also in the size and shape of the grain than is usually done. Ears that are uniform in size, shape, appearance, and character of dent indicate greater purity of strain. This means greater uniformity in maturing, and also more uniformity in time of flowering, which is very important. Those plants in a field of maize which flower much later than their neighbours have little chance of being properly fertilized.

Uniformity in colour of cob is an important point. The inclusion of a seed ear with a red cob among others with white cobs, leads to the production of an objectionable admixture of variously coloured grain. Uniformity in the colour of grain in the selected ear is also a point to be remembered.

Different general types will be found suited to different conditions of soil and climate, and pure bred varieties of maize, which are adapted to the conditions under which they are grown, give not only a higher yield, but also one of better quality than those of unsuitable or mixed type.

Ears which have their butt ends well rounded and filled with grain will be found to shell a good percentage of grain. Well rounded butts are usually indicative of a good strain. The filling of the tips of the ears with grain is perhaps not so important. The best type of tips is one which is oval or rounded, and fairly well filled with grain of uniform regular size.

In selecting corn for seed purposes special care should be taken only to select such ears that are free from fungus disease, or are undamaged by insect pests, or by weather. All ears showing any trace of mould, dry rot, or splitting of the grain, or any sign of weevil attack, should be avoided.

Bearing in mind the advisability of keeping the seed acclimatized by continuing to select seed ears grown on the farm, even though below standard size if the crop is poorer than usual, it will most likely be found that it is impossible to get many ears with all the characters perfect in an unfavourable season. In fact, many perfect ears cannot usually be obtained even when selecting from a good crop, but a good foundation can be laid for improving maize in these characters by the establishment of special seed plots of about an acre in area. Cross-fertilization is thus effected between the best types each year, and tangible improvement can be seen after a few seasons.

A summary of the chief points to be observed in selecting maize in the barn is given in the following ten rules:—

- (1) Select ears which are heavy in proportion to their size when dry.
- (2) Select ears which are cylindrical in shape or nearly so, and avoid very tapering ears.
- (3) Select ears with straight rows, regular from butt to tip.

(4) Select ears with well rounded and well filled butts and tips

(5) Avoid ears with wide spaces between rows of grain.

(6) Do not strive too much after small cores—a larger core carries more grain.

(7) Grain should be of uniform wedge shape, full-tipped and thick.

(8) A rough dent is usually indicative of deep grain.

(9) The core should be uniform in colour, and the grain also should be of a uniform bright colour.

(10) The grain should be in good condition and well matured—dry, sound, and firm on the cob.

COMPRESSED GRAIN.

A correspondent in a recent number of the *London Times* (October 16, 1917), referring to the present need of an increase of the stores of corn in consequence of the present war, mentions a process suggested as a method of conserving grain by the late Lord Masham in 1905, when a Royal Commission on the Supply of Food and Raw Material in Time of War submitted their report. Lord Masham, who was then ninety years of age, had been quietly experimenting on the subject, but allowed some time to lapse before bringing his invention to the notice of the Royal Commission. His proposals, however, in view of present difficulties, seem to be of such great importance, that the correspondent in question (Mr. John Hutton) ventures to bring them before the public in Lord Masham's own words. He wrote: 'I will forward you the small sample of compressed wheat that was made three years ago; the process is quite simple, and can be done for less than 1s. a quarter. The wheat is first crushed or rough ground as if for cattle. It is then steamed to soften it for any suitable compressing machine; the steaming is of the utmost importance and value, as the high-pressure steam kills all the germs of the parasites which damage and destroy crude corn when stored in the ordinary way. Anyone can try the experiment at the cost of a few pounds. The sample sent was pressed in a common oil mill. Probably bricks might be the best form for storage, but that is a detail. As from the first the invention was intended for the national good I did not patent it, but simply registered it to prevent anyone else from doing so. The sample sent would, I have no doubt, keep for hundreds of years, provided that it was always kept dry—everything would depend upon that. When used, put the compressed blocks or cakes through crushing rollers, and then grind it, and the flour will be as good a hundred years hence as it is to-day.'

It appears that upon reading the Commissioners' report referred to above, Lord Masham determined to put before the Government a practical scheme which he thought would satisfy both the Government and the nation in making provision for a sufficient supply in store, in case of war. To quote his words: 'I think I can form a company that will store, say, 10 million quarters of corn (or, say, a four-months' supply) upon a payment of 1s. 6d. per quarter per annum. This would come to £750,000 a year; but it would really cost the nation nothing, as with a four-months' consumption of food in store, the whole of it might be saved, and would be saved, out of the cost of the navy, and in case of war, the company would have to be paid 35s. a quarter for every quarter taken out of store. The nation could not grumble at that. . . . The company would undertake not to put into store more than a million quarters a year, so as not to disturb

the corn market, unless prices were very low, and then a great deal more might be done. The Government inspectors would see that the corn in store was always sound and in good condition, and if not, that the company replaced it with fresh. On the above basis I think I could in six months form a company, as I should have some machines to make and put to work to show the public how it would have to be done. Might I ask you to be so obliging as to put the proposal before the Commissioners, and ascertain if they would entertain it?'

The scheme, it would seem, was submitted to Mr. Balfour, then Prime Minister; but shortly after, there was a change of Government, and in 1906 Lord Masham died, and the matter dropped. Mr. Hutton concludes by expressing the opinion that if Lord Masham's invention had been adopted by the Government, and a four-months' supply of flour stored, the anxieties with regard to food during the present war would have been considerably relaxed.

The foregoing should be read with interest by those concerned with maintaining adequate food supplies in the various colonies in the West Indies.

THE COTTON OUTLOOK FOR 1917-18 IN THE UNITED STATES OF AMERICA.

Reports from the cotton belt are anything but encouraging. Low temperatures have been experienced in many sections, which have further accentuated the lateness of the crop. This is most disquieting when the need for a large yield is so essential.

Reports advise the steady migration from the South to the North of negroes, and it is estimated that 309,000 have left the cotton belt during the last eight months.

The successful prosecution of the war is receiving greater attention than trade, but this cannot continue indefinitely. The strong statistical position of cotton, which will be emphasized by the probability of the new crop being inadequate to provide a surplus over requirements, must command attention. Everything points to the cotton supply position during the next eighteen months occasioning the cotton trade of the world anxiety.

The stocks of manufactured goods throughout the world are acknowledged to be low. Consequently at some future date replenishment must take place.

The probability is that demand from countries other than Europe would be large, given reasonable facilities for trading. Therefore, in looking ahead, it would be unwise to place the world's requirements of American cotton under 14,500,000 to 15,000,000 bales.

The importance of augmenting the cotton supply has been repeatedly urged, but never before was the necessity so urgent, as at present, to avert a shortage. (*The Queensland Agricultural Journal*, September 1917.)

Acreage under Cotton in St. Vincent.—According to official returns recently received at the Head Office of this Department, the area under Sea Island cotton in St. Vincent is 2,614 acres, and in the Northern Grenadines, which form a part of the colony, 725 acres, making a total of 3,339 acres. Of this, 1,997 acres are cultivated on estates, and 1,342 by small holders. In addition there are 1,232 acres under Marie Galante cotton in the Southern Grenadines of the colony, 460 acres on estates, and 771 acres on small holdings. These figures show an increase under cotton of 1,118 acres as compared with last season, being 937 acres more under Sea Island, and 181 more under Marie Galante.

EDITORIAL

HEAD OFFICE



NOTICES.

— BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial concludes a series on educational possibilities in the West Indies. It deals with the question of technical education in agriculture of pupils from elementary schools.

The production of light in certain animals, especially fire-flies, is discussed on page 410 under Insect Notes.

Bacterial diseases of tomatoes in St. Vincent is the subject of the Plant Disease Notes on page 414.

An interesting article on the selection of corn for seed will be found on page 406.

Hibiscus Waimeae.

Referring to a note in the issue of this Journal of December 1, which brought this hibiscus to the notice of our readers, Mr. J. Jones, Curator of the Botanic Gardens, Dominica, writes as follows: 'Cuttings of the above species were sent to me by Mr. Wilder, of Hawaii, some years ago, and fortunately one grew. Progress in propagating was slow owing to the difficulty of striking cuttings, hence propagation has been mainly by layering. Two beds of this plant are now growing in the Gardens here. If grown under good conditions, *Hibiscus waimeae* is highly floriferous, much more so than *H. Rosa-sinensis*.

'A semi-double white hibiscus was also received from the St. Lucia Gardens about a year ago, and is now being propagated.'

Research Work in Connexion with Cotton.

Arrangements, referred to in a previous issue of the *Agricultural News* (No. 400, p. 258), have now been completed for the carrying out of research work in connexion with cotton under the auspices of the British Department for Scientific and Industrial Research, and under the general direction of the Imperial Commissioner of Agriculture for the West Indies. For this purpose provision has been made for Mr. S. C. Harland, B.Sc., Assistant Agricultural Superintendent of St. Vincent, to be partially seconded in order to carry on this work. He will, for the present, pursue his researches in St. Vincent.

The provision of means for undertaking abstract research in a branch of agriculture marks a distinct advance in relation to scientific progress in these colonies.

The Barbados Agricultural and Industrial Exhibition.

The Annual Exhibition, under the auspices of the Barbados General Agricultural Society, was held on December 12 at Queen's Park. The weather was everything that could be desired, and the attendance, on the whole, decidedly better than that for some years previously.

The exhibits of agricultural products were creditable, considering the very dry weather that had been experienced during the past several months. Particularly good as regards size were the exhibits of ground provisions, and fruit. Exhibits of poultry, although not up to the standard of previous years in point of number, yet maintained a high standard of excellence in the majority of varieties shown.

The art section was fairly well represented. The subjects in oils, both figure and landscape, as also the water colour drawings, attracted much attention.

As regards live stock, the show of milch cows, young bulls, and heifers, and also of sheep, was quite up to the standard of previous years. The Goat Society's show, which since its organization under the aegis of the Imperial Department of Agriculture, has been held in connexion with the Industrial Exhibition, was very interesting. There was a large number of goats of

the best imported pedigree strains, which attracted considerable attention and bore testimony to the improvement due to imported strains. Specially deserving of notice was the winner of the first prize in Class 1. This goat, 'Snowdrop', is an animal of extraordinary size, her milking qualities causing her to be regarded as one of the best of her kind to be found anywhere. Her milk yield on the exhibition grounds, ten months after kidding, was 5 lb. 14½ oz. although she had been milked dry at 5 o'clock on the previous afternoon—a good yield for a well bred Jersey cow.

On the industrial side, excellent workmanship was displayed in the exhibits of various handicrafts. The exhibition must be considered to have been a decided success, but it is a matter for some wonder why the exhibits in each class were comparatively so few in number. One hoped, for instance, to have been able, in such a sugar-cane island, to have shown to intelligent strangers more than six clumps of cane, good as those were.

Agriculture among the Aborigines of America.

A short, interesting account of the agriculture of the North American aborigines may be found in a paper on land tenure and the organization of agriculture on Indian reservations in the United States, prepared under the direction of the Commissioner of Indian affairs, Mr. Cato Sells, in the *International Review of Agricultural Economics*, May 1917. It is stated that almost without exception the early explorers found the Indians in what is now the United States, from the border of the Western Plains to the Atlantic Ocean, dwelling in settled villages, and cultivating the soil. De Soto found all the tribes visited by him, from the Florida Peninsula to the western part of Arkansas, cultivating maize and other food plants. The early voyagers found the same thing true along the Atlantic coast. Captain John Smith, and indeed all the early colonists depended at first very largely for food supplies upon the products of Indian cultivation. Jacques Cartier, the first European to ascend the St. Lawrence, found that the Indians had, as he says, good and large fields of corn. Champlain, another early French explorer, speaks of the cultivation of the soil for food by the Iroquois. La Salle observed the cultivation by the Indians of maize. In addition to the maize crop, beans, squashes, pumpkins, sweet potatoes, and tobacco were cultivated to a considerable extent by the Indian tribes, especially in what are now the Southern States. Marquette, speaking of the Illinois Indians, says that in addition to maize they also 'sowed beans and melons which are excellent, especially those with the red seed.'

In regard to the tribes further West, the Pueblo Indians are known to have been tillers of the soil, and though the implements used, and the methods of cultivation were both simple and primitive, cotton, corn, wheat (after its introduction), beans, and many varieties of fruit were grown in abundance.

The Indians of Arizona and New Mexico had learnt the art of irrigation before the appearance of

the white man. Existing remains of their ditches are estimated to have been sufficient for the irrigation of at least 250,000 acres.

There is definite evidence also, that the Indians used fertilizers. The Plymouth colonies were advised by the Indians to apply fish to their old grounds. It is also stated that the Iroquois manured their land. Lescarbot says that the Virginian Indians and others enriched their fields with shells and fish. The implements they used in cultivating the ground are described by him as 'wooden hoes and spades made of hardwood.'

The Health of Hogs.

In a letter which appeared in the *Journal of the Jamaica Agricultural Society* for September 1917, Mr. Archibald H. Ritchie, Government Entomologist, points out that a properly constructed hog wallow of concrete would largely conduce to the keeping of hogs in health. The wallow, besides being a means whereby disease and parasites can be controlled or prevented, is also a means of adding to the comfort of the animals. A sanitary hog wallow charged with a reliable disinfectant and lice killer has become an essential part of the furnishing of all well conducted hog farms in the United States. If the sanitary wallow for hogs be adopted in preference to a loathsome, filthy, mudhole, the increased bodily comfort of the hogs, and the prevention of disease amongst them, and control of parasites on them may lead the way to success in pork production. The construction of a wallow is shortly outlined as follows:—

(1) Excavate a hole about 10 feet square by 2 feet deep.

(2) Fill in with gravel or marl to a depth of 10 inches, and ram well.

(3) On top of the gravel spread 4 inches of concrete composed of 1 part of cement, 2 of sand, and 4 of gravel. Pack well, and leave the floor rough to prevent the hogs slipping. The floor should slope gradually to one corner so that the wallow may be easily drained. A drain pipe with a plug may be led from this corner.

(4) Side walls of concrete 12 inches high from the floor, and 4 inches broad should then be erected. The 2 inches of space above the ground level prevents the inflow of surface water.

(5) Construct a slope to one of the side walls about 4 feet in length from the floor level, as an exit, and corrugate this slope to prevent hogs slipping in going in and coming out.

(6) Erect a shed over the wallow with any rough lumber, as a shade for the hogs, and to keep the wallow cool.

(7) The wallow should be charged to a depth of 10 inches, using either water with ¼-inch layer of crude oil, or preferably, such a dip as 'Kreso', which acts as a combined disinfectant and insecticide.

A simple method of controlling lice on hogs has lately been employed, it is said, in Mississippi. Piles of sand saturated with crude oil are placed under the rough shed erected for the shade of hogs in the field or yard. The hogs delight to wallow in this material, and fleas, lice, etc., are thereby held in check.



INSECT NOTES.

THE PRODUCTION OF LIGHT IN CERTAIN ANIMALS.

The mechanism of light production is found in several of the lower animals, and since the light given off by them looks like that of phosphorus, the term phosphorescence is often used to express this phenomenon. As will appear later, this term is not really correct in view of recent researches, and it has been suggested that the more general term luminescence be employed. In the following notes it is proposed first of all to refer to some of the luminous animals and their habits, and secondly to give some account of the recent investigations as to the source of light in certain luminous animals, particularly fire-flies.

Much of the phosphorescence or luminescence of the sea is due to minute marine protozoa belonging to the genera *Pyrocystis* and *Noctiluca*. In the species *Noctiluca miliaris* the luminescence glows as a rule only when the animal is agitated, and a persistent stimulus causes a continuous but weak light. The luminosity resides in minute points, mostly crowded in the central mass, but also scattered all through the protoplasm of this small one-celled animal. A slight irritation only produces luminosity at the point touched; a strong one causes the whole to flash. It is stated that any form of irritation, whether of heat, touch, or agitation, electricity or magnetism, induces the glow. (*Camb. Nat. Hist.*, Vol. I, p. 134.)

Light production also occurs in one of the marine burrowing molluscs, *Pholas*, in an ostracod or shell-covered crustacean *Cypridina*, and in a few other marine forms.

It is among certain members of the insect world that we get the greatest development in the mechanism of light production. The light producing insects in the American tropics are commonly grouped under the general term 'fire-flies', while in Europe the term 'glow-worm' is also used in connexion with the wingless, worm-like females.

Fire-flies belong to two different families of beetles the Lampyridae and the Elateridae. Members of the family Lampyridae occur in many parts of the world, and include species of the genera *Lampyris*, *Luciola*, etc., in Europe, and Japan, and *Photinus*, *Photuris*, *Lucidota*, etc., in the American tropics. These are the true fire-flies, and are all comparatively small insects; some of them are quite common in most of the West Indian islands. The larger kinds of luminous beetles belong to the genus *Pyrophorus* of the family Elateridae or click-beetles. These occur only in the American tropics, including some of the West Indian islands. The commonest species *Pyrophorus noctilucus* is known in some islands as the 'cucullo', and in others as 'La Belle'.

In Southern Europe fire-flies belonging to the genus *Luciola* swarm in large numbers on calm, warm nights. Sharp states that these are nearly all males, while the females are rather rare. The light of the male is more brilliant than that of the females; its wings and eyes are more strongly developed, and it is thought that in this case the lights of the male are displayed in rivalry.

In the British forms the female is entirely wingless, and

is commonly called a glow-worm, while the male has wings, and is able to fly about. The light of the female is more conspicuous than that of the male, and in this case it seems probable that the light of the female serves to attract the males. (*Camb. Nat. Hist.*, Vol. VI.)

In the Eastern and Southern United States the common fire-flies belong to the two genera *Photinus* and *Photuris*. An account of these luminous insects appeared in the *Journal of Heredity* for August 1917, from which article the following notes are taken.

Photinus, the commoner of the two, is rather delicate, and flies near to the ground, flashing frequently, and giving off an orange or yellow light. The male has a larger light-producing apparatus than the female.

Photuris, on the other hand, is strong and hardy, carnivorous, flies high, and flashes only occasionally, giving off a greenish-yellow light. The lighting apparatus is almost identical in the two sexes.

It will be noted from the above that there is a distinct difference in the colour of the light given off by the two forms. Both produce a yellowish light, but while in one genus the light has a reddish tinge, in the other the light is distinctly greenish. It is also stated in this connexion that the colour of the light is useful in distinguishing the different species within the two genera, no two species giving off an identical shade. The green light has been shown by experiment to be the brighter light of the two. It must be remembered, however, that such a light as is given off by these insects probably has a different effect on the compound eye of insects than it has on the simple eye of man.

There have been various suggestions put forward as to the uses of the light produced by these insects. Some have thought that it serves to attract prey, others that it blinds the prey, and prevents its escape, others again that it blinds enemies, and prevents attacks. It has also been suggested that the light is simply an adornment, or that it serves to illuminate the path of the insect.

The most plausible view, however, seems to be that the light is used as a signal between male and female of the same species.

In this connexion the following account may be of interest. It is taken from a paper by K. G. Blair on 'Luminous Insects', a report of which appeared in a past number of *Nature*:—

'Apart from its principal function in securing the mating of the sexes, the light seems to be largely used, at any rate by the males, for purposes of display. Where the powers of luminosity are largely developed in this sex, the emission of the light is usually of an intermittent type. It has been noticed in various parts of the world that these flashing males tend to congregate in large companies, and that the individuals of one of these gatherings will flash in concert. All the fire-flies around one tree or group of trees, for instance, will flash together, while those around a neighbouring tree will be pulsating to a different time.'

Mr. Blair goes on to say that the exact reason of this flashing in concert, or the method by which it is brought about, has not been ascertained. He suggests, as an explanation of the phenomenon, that each flash exhausts the battery, as it were, and a period of recuperation is required before another flash can be emitted. It is then conceivable, he continues, that the flash of a leader might act as a stimulus to the discharge of their flashes by the other members of the group, and so bring about the flashing concert by the whole company.

HINTS FOR IMPROVING THE PRODUCTION OF CACAO FIELDS.

A leaflet recently issued by the Department of Agriculture, Surinam, gives some very practical hints as to the possibility of planters gradually increasing the yield of cacao from their plantations, without resorting to any drastic measures such as would materially lessen the crops obtained at present.

It is suggested that the trees on an area, not too large to be carefully superintended, should be numbered, and that the pods borne by each tree be counted and recorded separately for at least a year, taking three counts: the first count being of the pods produced in April or May, which give the chief crop, the second count being of those produced in October or November of the same year, and the third of those produced in April or May of the following year. From these recorded counts it would be possible fairly to classify the numbered trees, according to the amount of pods borne, into three classes—good, moderate, and bad. The trees registered as bad should then be marked plainly, say, by a ring of white-wash round their trunks, and suckers should be allowed to develop from the marked trees. These suckers, as soon as possible, should be grafted on with scions of an approved 'good' tree, and the original 'bad' ones should be cut down. As to the 'moderate' class, the suggestion is to keep them under observation for a further period, and then select the worst of these and proceed in the same way with them as that in which the 'bad' were dealt with, and so gradually eliminate all but the 'good'. In this way, after a few years a cacao planter would have his orchard completely stocked with trees of an approved productiveness.

Grafted Mangoes in East Africa.—The improvement of the mango has long been considered desirable by the Agricultural Department of British East Africa, but the difficulty has been the obtaining of grafted plants of choice varieties. The Annual Report of the Department, 1915-16, states that this difficulty has been overcome by the safe arrival, in November 1915, of a Wardian case containing nine grafted plants of the choice varieties, 'Mango Julie' and 'Pere Louis', shipped from the Botanic Station in Dominica, at the request of the Imperial Commissioner of Agriculture for the West Indies. No time was lost in planting them, and seven of them are doing well. Stocks for grafting purposes, which operation will be carried out as soon as possible, have been raised from seeds of local varieties.

VETERINARY REPORT FROM ANTIGUA.

The report on the general health of the stock in Antigua for the year ended March 31, 1917, by the Government Inspector of Animals, Mr. H. Goodwin, V.S., has been recently forwarded by the Acting Governor of Antigua to the Imperial Commissioner of Agriculture for the West Indies, for his information.

There are several points worth noting in this report of a year which was a comparatively healthy one among animals in Antigua.

Epizootic lymphangitis, which has often been the cause of much trouble to the owners of horses, mules, and donkeys in that island, seems to have been held in check during the year reported on. Mr. Goodwin finds that mules and donkeys suffer more frequently than horses from this contagious disease, and he attributes this chiefly to the herding

together of mules, and to the unclean condition in which harness is often kept. Mr. Goodwin appears to attach little importance to flies as carriers of infection of this disease, but Lieutenant Saunders, M.R.C.V.S., points out in the *West Indian Bulletin*, Vol. XIV, p. 168, that 'flies are undoubtedly often concerned mechanically in the transmission of the disease.' The plan of segregating diseased animals is one doubtless to be recommended.

Tetanus is reported to have been rather prevalent, but the use of anti-tetanic serum has had an appreciable effect in lowering the mortality from this cause.

A wide-spread epidemic of strangles among horses and mules was traced to the importation of a cargo of mules from America, several of which developed the disease in a severe type. Generally speaking, however, the disease manifested itself in Antigua under a mild form, and caused but few deaths among the animals affected.

Mr. Goodwin rightly insists on the supreme importance of clean pasturage and pure water, if the animals on estates are to be kept healthy.

It is not a good thing for the prosperity of the island, as regards food supplies, as Mr. Goodwin points out, that there should be a noticeable diminution in the number of sheep and goats reared both on the larger properties and by the labourers on small holdings. It is hoped that this is only a temporary state of affairs.

An outbreak of swine fever or hog cholera was noticed in November 1916. This was traced to the importation of two sows from America at the end of October. They had both been guaranteed healthy, and purchased from places where hog cholera did not exist. On the voyage from America they were kept and fed together, and on landing they appeared perfectly well, yet one died from this virulent disease a week after landing. The other has remained perfectly well, and has given birth to a litter of pigs. Soon after the death of the one, other pigs on the estate to which she had been sent began to sicken and die. In spite of Mr. Goodwin's suggested precautions, the disease spread widely, as he was unable to prevent the movement of pigs from an infected to a healthy district.

In connexion with the immunity of the one sow, it would be interesting to discover whether before shipment this animal had been treated by the complete inoculation described in *Farmers' Bulletin*, 834 of the United States Department of Agriculture, referred to in No. 407 of this Journal.

An annual review of this nature on the conditions affecting farm animals is calculated to be most useful, and stock owners will be well advised if they regularly inform themselves of the conditions prevailing in their districts, and take steps to remedy defects.

The *Field* for October 27, 1917, states that, to general surprise, *Feijoa Sellowiana*, or as it is commonly known, pine-apple guava, has proved to be quite hardy in the warmer parts of England. Although it flowers very freely, it has not produced fruit. Still it has decided claims to favour in the elegance and colour of its large myrtle-like flowers. These are about 2 inches across, with white sepals, blood-red petals inside, and a blood-red brush-like cluster of stamens. When in flower the plant is truly handsome. The fruit, which is not unlike the guava in size and flavour, is egg-shaped and about 2 inches long, with a thin, green skin, and juicy aromatic flesh, in which flat, kidney-shaped, hard seeds are embedded. The plant is a native of Brazil, but has been introduced into many other tropical countries. Specimens of it introduced into the Botanic Gardens in Dominica in 1912 had made fair growth by 1915.



GLEANINGS.

The Comparative Statistical Report of sugar manufactured in Porto Rico from 1909 to 1917, issued by the Government, shows a wonderful increase in production which has almost doubled. In that island 277,092 short tons were made in 1909, whereas the crop of 1917 has reached the total of 503,081 tons.

Turmeric (*Curcuma longa*) is cultivated all over India for its rhizomes, which are used as a condiment and also as a dye. The dye attaches itself readily to wool, silk, or cotton. Calcutta dyers obtain a brilliant yellow by mixing turmeric with carbonate of soda, and along with indigo, shades of green are produced. (*The Wealth of India*, August 1917.)

Progress in the development of the indigo industry in India is the subject of an article in *The Times Trade Supplement*, June 1917. The conclusion is reached that indigo may be produced in India, and sent to England in paste form ready for use, at prices which will put it on a level with the artificial material manufactured by German methods, which had almost ousted it latterly from the market.

According to an article in the *Jamaica Gleaner*, November 2, 1917, there has been a movement among banana planters to secure some fund for ensuring the banana industry against future hurricanes. At a meeting held at Highgate, a resolution was passed to approach the Government on the question of the rating of one half-penny on every payable bunch of bananas exported from the island, to form an insurance fund.

In 'Seasonal Hints', November 1917, published by the authority of the Minister of Agriculture, Ottawa, Ontario, some useful advice is given to poultry keepers. Hens over two years old, it is stated, ought to be sold or eaten. Only the best of the one-year-old hens which have proved their fertility should be kept. It does not pay to keep old hens. A two-year-old Leghorn hen may be worth keeping, but a two-year Plymouth Rock hen is usually a loss.

The Committee appointed by the Government of British Guiana to enquire into and report upon the leasing of Crown Lands, and whether the policy of selling Crown Lands to small cultivators should be revived, has presented their report, in which they conclude that under certain modifications it is advisable to revive that policy. The report is published as a paper of the Second Special Session, 1917, of the Combined Court of British Guiana.

According to an article in the *Farm Journal*, November 1917, one of the easiest ways to kill rats is to run the exhaust fumes from a motor car into the rat holes. The plan is to close up all the rat holes except one, in a building, and having attached one end of a sufficient length of ordinary hose to the muffler of a motor car, to put the other end down the rat hole left open, and start the engine. The method is said to have been very successful.

Professor Antonio Berlese, in a recent book on insects infesting houses, recommends that a solution of sodium arsenite (2 per cent.) and molasses (10 per cent.) in water should be sprayed, every eight or ten days when flies are prevalent, on plants near houses, and on manure heaps, and that bunches of straw or twigs should be dipped in the solution and hung up outside houses, near doors and windows, as a means of destroying house flies. (*Nature*, November 1, 1917.)

Work on control of Japanese nut grass (*Cyperus rotundus*—a noxious weed in the West Indies also) has proved that spraying with arsenite of soda is the most effective means of control, if the spray is applied when the grass is in full bloom. Ploughing with a disc plough is also effective, if done at intervals of four or five weeks during exceedingly dry periods. The tubers found on the surface of the soil after effective ploughing can be raked together and destroyed. (Report of the Hawaii Agricultural Experiment Station, 1916.)

The Board of Trade Journal, September 6, 1917, states that a Law has been published in Venezuela which prohibits the killing and hunting of herons in that country, and also the exploitation and exportation of egret plumes except under the regulations prescribed by the Law. No one may collect egret plumes, or export them without a certificate vouching for the fact that they have not been obtained by the prohibited method of killing the bird. Egret plumes are only to be collected at the heronries during the moulting period, from July to November inclusive.

In *Colonial Reports*—Annual, No. 932, the Colonial Secretary of the Bahamas states with regard to the trade of those islands, that the exports of preserved pine-apples, grape fruit, and tomatoes show steady increases in quantity and value. There was a satisfactory increase in the export of sponges, particularly in the better grades, both in quantity and value. The total sponge output for the year was 1,317,622 lb., valued at £136,551. Exports of sisal have also increased, amounting to 8,369,245 lb., valued at £114,465.

There is evidently a movement in Jamaica in favour of extending rice cultivation in that island. A correspondent in the *Journal of the Jamaica Agricultural Society*, October 1917, states that the possibilities in Jamaica for growing rice have never been seriously considered until very recently in the western parishes. The extensive cultivation of rice will not displace any other industry, and every shilling gained from it would be a direct addition to the wealth of the island. While some development has taken place within the last year in rice growing, it is nothing like what there is room for. A yield of as much as 40 bags to the acre, each of 160 lb. weight, has been reaped here under favourable conditions. Twenty bags to the acre can be put down as a fair average yield.

SUGAR-CANE VARIETIES IN ST. KITTS.

At a meeting of the Agricultural and Commercial Society, St. Kitts, held on October 2, Mr. F. R. Shepherd, the Agricultural Superintendent, read a paper setting out the results of experiments with varieties of sugar-cane during the past season in St. Kitts. Some account of these will be of interest doubtless to cane planters elsewhere.

As in previous years, the experiments have been carried on at two principal stations, La Guérite and Molineux, which are situated on opposite sides of the island, the former being on the leeward side, and the latter on the windward, and on six subsidiary stations in various parts of the island. At these subsidiary stations twenty-four selected varieties were grown for experimental purposes, viz., sixteen Barbados seedlings, five Demerara seedlings, one Antigua seedling, Sealy Seedling, and White Transparent. At the two principal stations there were grown, in addition to these twenty-four, seven other seedlings from Barbados, three others from Demerara, and six others from Antigua, while at La Guérite a further selection of twenty-four of the newer seedlings from Barbados, Demerara, Antigua, and Mauritius was also planted. It will thus be seen that there was a wide range of varieties under observation.

The manurial treatment of the fields was in all cases the same as that given to the other fields on the estates where they were grown. They all received an application of pen manure, except in one instance, where a green dressing of pigeon peas was applied.

From the results as tabulated, it appears that B. 6308 heads the list with a calculated weight of 33.2 tons of cane per acre, and 7,820 lb. sucrose in the juice. B. 6388 comes second, with a calculated yield of 30.8 tons per acre, and 7,670 lb. sucrose. Both of these varieties are recommended for trial on a larger scale.

The third and fifth places are taken by B.4596 and B.208. The former actually takes the first place as to yield of cane, 37.1 tons per acre, but has a low sucrose content, and is suspected of showing signs of deterioration and susceptibility to root disease, which is also the case with the latter, although this variety possesses a high sucrose content. Neither of these varieties therefore is recommended.

The cane, however, which comes fourth on the list, B.376, with a calculated yield of 32.1 tons of cane per acre, and 7,260 lb. of sucrose, is highly recommended for trial.

Among the other Barbados seedlings grown on all the stations, the following are recommended for trial on a larger scale: B.3859, B.1528, B.254, B.4934, and B.6346.

Of the Demerara seedlings, D.116 and D.109 are varieties of promise in St. Kitts, the former being apparently well suited to the northern part of the island. Planters are advised not to grow D.625, in spite of its large calculated yield of cane, 35.4 tons per acre, because of its bad milling qualities, which cause it to be looked upon with disfavour at the Basseterre Sugar Factory.

The Antigua seedling, A.2, has proved very successful in the northern part of St. Kitts, and is a favourite among the planters there, but in the station experiments on a small scale it has not given such good results.

The Sealy Seedling, which has given satisfactory results in other places, particularly in Antigua, does not seem to be suited to the conditions in St. Kitts, either on the experiment stations, or when tried on estates on a large scale.

Of the varieties grown only at La Guérite and Molineux, there are singled out as showing great promise, D.118, D.419, and A.95, giving calculated yields per acre of 37.4 tons, 35 tons, and 30 tons, respectively.

Two newer Barbados seedlings, Ba.6032 and B.H. 10 (12) are noticed as likely to be valuable. Some of the varieties received from Mauritius also show signs of promise.

A noteworthy feature of the experiments this season has been the inclusion of sixty locally produced seedlings at Brighton estate. These seedlings were grown by the Manager, Mr. George Yearwood, and sixty out of some 600 were selected by him and Mr. Shepherd as worthy of trial. Forty-two of them are considered deserving of further attention; one especially seems to promise excellent returns. It will be most interesting to watch the results which may be obtained. An indigenous seedling may perhaps be produced more suitable to local conditions than any of those imported.

Referring to the work of the Basseterre Central Factory for the past season, Mr. Shepherd points out that 11,843 tons of sugar were manufactured from 97,372 tons of cane, that is at the rate of 1 ton of sugar to 8.22 tons of cane, showing the high sucrose content of the canes, and the efficiency of the working of the factory. On the other hand, when the acreage from which the canes were supplied is examined, it appears that only an average of about 23 tons of plant canes per acre, and 15 tons of ratoons were produced in a season when the weather conditions were favourable. This ought to be considerably improved by the planters. Mr. Shepherd suggests that attention be paid to three points in this connexion: 1. To increasing both the quantity and quality of pen manure. 2. Selection of only healthy cuttings for planting. 3. The question of liming the soils. He has no doubt that considerable increase in the quantity of cane grown per acre may easily be attained, granted favourable weather.

SUGAR CROP PROSPECTS FOR 1918.

Seeing that the sugar plantations in the smaller West Indian islands will soon begin the cutting of the canes for the next crop, it seems of interest to give some forecast of the crop in St. Kitts and Antigua, based on the reports which come monthly to hand at the Head Office of this Department.

In St. Kitts for the first six months of the year just passed, it was reported monthly that the young canes were suffering much from want of rain; only 16.79 inches were recorded at the Botanic Station during that period, as compared with 21.14 inches in the corresponding period of last year. In July there were some showers, but insufficient to cause really satisfactory growth, and from then on to the end of November the report has been that of a continuation of dry weather, the total rainfall for the eleven months of the year being only 35.89 inches compared with 63.17 inches last year. As a result, the crop prospects are very poor in St. Kitts, one authority thinking that the crop will be little more than half of that reaped last year.

The reports from Antigua for the first five months of the year were very much in the same tone as those from St. Kitts, or perhaps more gloomy, want of rain severely retarding the growth of the crop. In June, however, the much needed rain fell in sufficient quantities to start vigorous growth, and the reports became more cheerful. The rainfall was 25.26 inches for the first six months of the year, compared with 19.47 inches for the corresponding period of 1916. Up to the end of November, the rainfall, though only moderate, being 37.06 inches, compared with 63.13 for the same period of 1916, has enabled the growth of the canes to be maintained, the report being that the crop outlook was fairly promising, though not perhaps as good as for the last crop.

PLANT DISEASES.

BACTERIAL DISEASES OF TOMATOES IN ST. VINCENT.

WILT.—During the recent visit of the writer to St. Vincent some attention was given to a wilt disease of tomato plants, which was found to be occurring in beds of hybrid tomatoes (*Ponderosa* × *Native*), and in a row of the variety *Earliana* from American seed, grown by Mr. S. C. Harland at the Experiment Station, Kingstown. The symptoms of the affected plants, the appearance of the associated bacterium under the microscope and on agar cultures, and its virulence when inoculated into healthy plants, leave no reason to doubt the identity of the disease with the wilt due to *Bacterium* (*Bacillus*) *solanacearum*, Erw. Sm.

This disease is very prevalent in the Southern United States, and prohibits the growing of tomatoes over large tracts of country. A closely similar, probably identical, affection has been reported in many countries of the Old World. Several other members of the natural order Solanaceae, especially egg-plant, potato, tobacco, and *Datura* spp., are liable to serious diseases produced by the same organism. The whole series has been grouped together under the name of Brown Rot of Solanaceae, and very fully treated in Vol. 3 of E. F. Smith's monumental treatise 'Bacteria in relation to Plant Diseases.'

So far as the records of this Department show, the disease has only been previously reported in the Lesser Antilles on one occasion, on tomatoes from Union, St. Lucia, in January 1904.

The outstanding character of the affection on tomatoes, as seen in St. Vincent, is the wilting, usually sudden, of the whole plant, which has just the appearance which would be produced by severing the base of the stem from the roots. No preliminary browning of leaves or stems was observed. When the bacterium was artificially introduced into a single stem, wilting above the point of the inoculation took place in from two or three days to a week, while backward infection proceeded only slowly.

Since wilting of the same type is produced by *Fusarium* disease, and would ensue from any other cause which cut off the supply of water through the stem, it is necessary for the purpose of a field diagnosis to have some further evidence of the presence of this particular disease. Confirmation fairly satisfactory for this purpose may be obtained by cutting across the stem at intervals with a clean sharp knife. When the region of infestation is reached the woody ring in the stem is found to be discoloured brown, and in a short time dirty white or brownish beads of bacterial ooze collect on the ends of the cut vessels. In the region of serious infestation this discharge is copious enough to be quite apparent to the naked eye. The pith may or may not be discoloured; the principal seat of the disease is in the vascular tissues, from which circumstance, when the infestation of any section of the stem is complete, the wilting of all parts of the plant beyond that section follows.

There seems to be no evidence of varietal resistance given in connexion with the published studies of this disease. *Solanum mammosum* is reported from Porto Rico to be resistant, and the suggestion has been made to use it as a stock for grafting tomato and egg-plant. At the St. Vincent station natural infection occurred to a considerable extent in American varieties of the *Ponderosa* type (which includes *Earliana*). The type with small round fruits, common in these islands and reputed to be native, proved fully susceptible to inoculations. A bed of F2 hybrids between *Ponderosa* and *Native* was with few exceptions des-

troyed when in full bearing. It is very much open to doubt whether the survivors were really resistant to the disease, in view of the known lessening of susceptibility to infection in matured plants. From whatever circumstance arising, some of the plants did resist artificial infection at this stage, and cuttings were taken from the survivors for further trial. A batch of hybrid seedlings, inoculated through needle pricks when a few inches high, succumbed in five days, showing at the point of introduction of the bacterium an infestation which was greatest in the protoxylem and the immediately adjacent cortical parenchyma.

The plants in which natural infections occurred were transplanted seedlings, in some cases very widely spaced, and the distribution of the diseased plants was of a sporadic type. In one rather close-planted row of *Earliana* several scattered plants died when coming into fruit without infecting their neighbours. The failure of attacked plants was completed at one stroke, and the indication given by this feature was confirmed in all the cases examined by the finding of the most severely affected sections at or near the base of the stem, and in one or more of the principal roots.

It seems on the whole most likely that infection had proceeded from the soil, probably, in some cases examined, through wounds made by removing basal shoots. The possibility remains, however, that wounds kept moist by nearness to the soil may have been more susceptible to infection from the pruning knife than those higher up, and it is somewhat easier to conceive of the knife becoming contaminated than the soil in some of the cases noted, where no Solanaceous plants appear to have been grown in recent times.

According to E. F. Smith, it seems probable that the organism is strictly a wound parasite. He has shown that it may be transmitted by insects, and is inclined to attach great importance to the action of nematode worms in opening the way for root infections, regarding their presence as prohibitive of tomato growing in infected soil. The St. Vincent plants did not show any obvious signs of the presence of nematodes. The further precaution on which most dependence must be placed, according to the author quoted, lies in avoiding even trifling injuries to the roots in transplanting. For this reason, if the seed cannot be germinated *in situ*, the transfer must be made with great care while the seedlings are still small enough to make the avoidance of injury possible. It is also obvious that infections may be easily made in pruning. A branch may be infested for a part of its circumference while not yet showing signs of wilt, and the cutting of it will smear the knife with large numbers of the causative bacteria. It would be safest to avoid pruning altogether when infected plants are known to be present.

It should be noted in conclusion, that it is reported from North Carolina and from Sumatra that ground nuts grown on infested soil have proved susceptible to the attacks of *Bacterium solanacearum*.

BACTERIAL FRUIT ROT. Attempts to infect tomato fruits with *Bact. solanacearum* resulted in slight local injuries which developed no further. This is in agreement with the results of previous investigators. There was present, however, at the Experiment Station, fairly well distributed, but not during the period of my observations causing more than moderate losses, a bacterial rot of the fruit of a very swift and decisive nature. Bacteria which invade injuries, and cause ripe rot of the tomato, as of other fleshy fruits, are not at all uncommon, but the one in question was distinguished by its ability to cause very destructive effects in fruit of any age, and ranging from the small 'native' to the large fruits of *Earliana*. Its outstanding character was the

formation of huge or very numerous gas bubbles under the transparent skin of the fruit, replacing the pulpy tissues as they were rapidly broken down. Finally the whole content of the fruit except the seeds was reduced to slime and gas, which escaped sooner or later by the rupture of the pendant skin, leaving the latter empty on the stalk. Needle point inoculation of half-ripe fruits in the evening gave rise to a hollow an inch in diameter in two or three hours, and by next morning the process was complete. Smearing of the skin with the slime produced did not cause infection unless a crack or other wound was present. The natural infections examined appeared to have their origin in bug punctures, made by *Nezara* and *Leptoglossus*.

Apparently pure growths of the bacterium were obtained by transfers from one fruit to another, and consisted of long actively moving rods. Cultures were obtained on nutrient agar, but time could not be spared from other work to continue the study further. Inoculations from diseased fruits into succulent stems had no effect.

No previous record has as yet been seen of a disease answering to this description.

W.N.

PINE-APPLE SEEDLINGS.

The pine-apple is one of the fruits, like the banana, which seems to have been so cultivated by forgotten races from pre-historic times as to have lost the power, except in rare instances, of producing seed. Seeds are, however, sometimes produced, and in considerable quantities, by rare individuals. Originally, in historic times at least, found in the Western Tropics, the pine-apple is now cultivated in every part of the tropical world. In Hawaii, for instance, it is one of the most important products.

The Report of the Hawaii Agricultural Station, 1916, contains some very interesting details of the work of the Agricultural Department there on the cultivation of the pine-apple, and the successful raising of seedlings from the infrequent seeds occurring in the fruits. Seedlings were obtained in 1913 and 1914, some of which have fruited in 1916. These seedlings have shown wide varieties. Some are vigorous, while others are feeble. Some of the seedling plants are green, while others show a brilliant red colouring. In some the leaves are narrow, in others broad. Some of the plants are smooth, while others are extremely spiny.

These results have led the Agricultural Department of Hawaii to believe that the collecting and breeding of varieties of pine-apples at present grown in various parts of the tropics might lead to the discovery of some which might do better in Hawaii than those now grown. Accordingly efforts are being made to obtain as large a collection of varieties as possible from different parts of the tropics.

It is hoped to obtain new varieties of known parentage by crossing established sorts, but as none of the introduced varieties have as yet flowered in the Experiment Stations, this has not been realized. The effort therefore to secure new and more desirable varieties has been confined to growing seedlings from plants which, as has been said above, produce seeds in rare instances in local plantations.

Through the co-operation of the large canneries in Hawaii, several thousands of seeds were obtained in the past year. The report, from which this article is drawn, says that it is interesting to note how rarely these seeds occur. The canneries dealing with millions of fruits may in some seasons find no seeds. In the season 1915-16, in one count of 63,000 fruits nine were found with seeds; in another count of 48,000 fruits only four had seeds. Yet, if the pine apple seeds at all, it is so prolific that it is estimated that those

thirteen seeding fruits yielded 2,433 seeds. So that, although seed bearing seems to be unusual, there was no difficulty in obtaining the requisite number of seeds to make experiments with in raising seedlings.

It was found that in order to germinate and raise these very tender plants several conditions were necessary: perfect drainage, constant and uniform supply of moisture, sufficient heat, and prevention of excessive algal growth on the surface of the seed bed. The clever and successful way in which these conditions have been fulfilled, with the result of raising a vast number of seedlings, is another of the triumphs of science as applied to agriculture by the Americans.

The following gives an account of the method pursued:—

'An inch or more of broken rock is placed in the bottom of the pot, and above this the pot is filled to within 1½ inches of the rim with a porous soil, on the top of which a layer of sand about ¼-inch thick is placed. This sand must not be of coral origin, since the lime in the coral is extremely detrimental to young pine-apple plants. Moulding sand, such as is used by ironworkers, has been found satisfactory. On this sand the seeds are placed, thus securing for them perfect drainage, while permitting the roots of the seedlings to penetrate easily the soil beneath. The surface of the sand is covered with coco-nut fibre dust mixed with a little powdered charcoal, which retards the growth of algae, and does not bake as does soil. The whole pot is then placed in a larger pot, and the intervening space is packed with moistened sphagnum moss. This prevents sudden changes in moisture conditions in a climate where earthen pots dry out quickly on the sides as well as from the upper surface. Water is never applied directly to the top of the soil, but when necessary the inner pots are removed and placed in water, which rises to the surface.

'A closed glass box in the greenhouse has been found to be advantageous, but not essential. The close atmosphere and high temperature aid in the early germination of the seed. Under such conditions pine-apple seedlings begin to appear about thirty-seven days after planting, while in the open, with cool winter temperature, and without the close, damp, atmosphere, sometimes two months or more is required for germination.

'When the seedlings begin to appear some shade is necessary. Too intense light causes the plants to lose their green colour and their vigour. A cheese-cloth over the plants, or a thin covering of whitewash on the glass of the box is sufficient.'

What the results of these seedling experiments with pine-apples may ultimately be, it is impossible to predict. Considering however the importance to the sugar industry that is now attached to raising new varieties of sugar-cane from seedlings—quite a recent development—it may not be too much to expect a considerable improvement, hardly perhaps in flavour, but in hardness and adaptability, of that queen of fruits, the pine-apple.

Some idea of the size and value of the citrus crop of California, and of the immense benefits conferred on growers by a well-organized association, is shown by the results obtained by the California Fruit Growers' Exchange, the largest and most successful of all the co-operative institutions formed by the fruit growers. During the year ending August 31, 1916, the Exchange shipped 9,615,855 boxes of oranges, 78,433 boxes of grape fruit, and 2,407,232 boxes of lemons. The amount of money returned by the Exchange to the shippers approximates \$27,703,000, nearly \$7,000,000 more than in any preceding year. (Statistical Report of the California State Board of Agriculture, 1916.)

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, November 1.

ARROWROOT—5½d. to 6½d.
BALATA—Venezuelan Block, 3/2½; Sheet, 3/9½ to 3/11.
BEESWAX—No quotations.
CACAO—Trinidad, 87/- to 95/-; Grenada, 90/-; Jamaica, no quotations.
COFFEE—Jamaica, 72/.
COPRA—£46.
FRUIT—No quotations.
GINGER—Jamaica, no quotations.
HONEY—Jamaica, 100/- to 110/- per cwt.
LIME JUICE—Raw, 2/6 to 3/-; concentrated, no quotations; Otto of lime (hand-pressed), 16/-.
LOGWOOD—No quotations.
MACE—No quotations.
NUTMEGS—No quotations.
PIMENTO—No quotations.
RUBBER—Para, fine hard, 3/1; fine soft, no quotations; Castilloa, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., November 22.

CACAO—Venezuelan, \$11.25 to \$11.50 Trinidad, no quotations.
COCO-NUT OIL—\$1.30 per gallon.
COFFEE—Venezuelan, 12c. per lb.
COPRA—7½c. per lb.
DHAL—No quotations.
ONIONS—\$8.00 per 100 lb.
PEAS, SPLIT—\$12.00 to \$12.50 per bag.
POTATOES—English, \$4.50 to \$5.00 per 100 lb.
RICE—Yellow, \$10.50 to \$11.75; White, \$9.25 to 9.50 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs. GILLESPIE BROS. & Co., December 1

CACAO—Caracas, 12½c. to 13c.; Grenada, 12c. to 12½c.; Trinidad, 12½c. to 13c.; Jamaica, 9c. to 10½c.
COCO-NUTS—Jamaica selects, \$40.00 to \$42.00; Trinidad selects, \$35.00 to \$38.00; culls, \$20.00 to \$30.00 per M.
COFFEE—Jamaica, 9½c. to 11c. per lb.
GINGER—16½c. to 21c. per lb.
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GRAPE FRUIT—Jamaica, \$2.25 to \$3.00 per box.
LIMES—\$6.50 to \$7.00 per brl.
MACE—32c. to 38c. per lb.
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PIMENTO—5½c. to 6c. per lb.
SUGAR—Centrifugals, 96°, 16.70c; Muscovados, 89°, 5.86c; Molasses, 89°, 5.57c. all duty paid.

Barbados.—Messrs. T. S. GARRAWAY & Co., October 30

ARROWROOT—\$8.00 per 100 lb.
CACAO—\$11.00 per 100 lb.
COCO-NUTS—\$36.00 husked nuts.
HAY—No quotations.
MOLASSES—No quotations.
ONIONS—\$12.00.
PEAS, SPLIT—No quotations; Canada, no quotations.
POTATOES—\$6.75.
RICE—Ballam, \$10.00 to \$10.80 per 180 lb.; Patna, no quotations; Rangoon, no quotations.
SUGAR—Muscovado centrifugals, no quotations.

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